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AUTOMOTIVE and Aviation INDUSTRIES

JUNE 15, 1944

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SERIAL RECORD
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What'll it be?

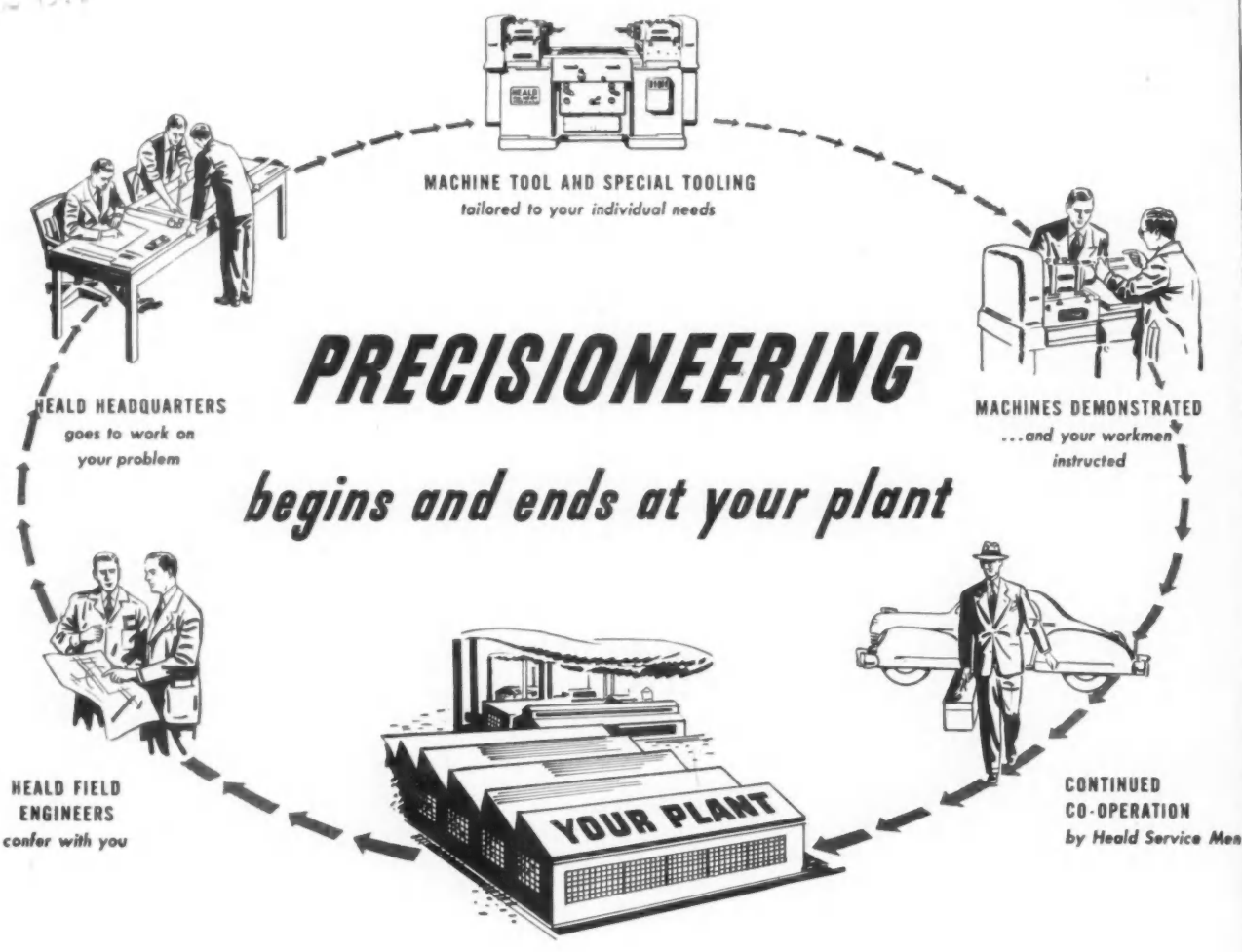
When that complex maze of lines on your drawing board soars into the sky of tomorrow what will it be—a deadly fighter or bomber—a touch-controlled helicopter—an enormously powerful airliner—or an undreamed of ship to sail the blue?

No matter what it may be, there is a Timken Bearing to give it lighter weight, compactness, maximum radial and thrust load-carrying capacity, freedom from friction.

Already, Timken engineers have developed a new series of tapered bearings that have these all-important aircraft qualities, as well as the advantages of assured smoothness of operation, conservation of power and endurance and economical maintenance. Consult us on your requirements. We will be glad to make recommendations. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

JUN 12 1944



PRECISIONEERING

begins and ends at your plant

..to help solve your production problems—now and post-war

You are planning a post-war product, or have a current problem. Costs must be low, production fast, precision limits accurately met.

You put the problem up to a Heald field engineer. Here, briefly, is how Heald Precisioneering goes to work.

From a group of 250 Headquarters Engineers, those with thorough knowledge of your field are selected. Every requirement of your problem is considered. Special tooling is designed to facilitate each type of machining operation. The Heald Precision Machine plus tailor-made tooling built through this "thinking-it-out" process is then proven in our testing division before shipment.

In your plant, the machine is set up, demonstrated, and your workmen instructed to get the most out of it. And if future problems occur, a phone call brings back a Heald Field Service Man... puts your Heald back on the job at peak production.

To turn out products faster, to achieve greater precision, to cut costs... let Heald Precisioneering help.

THE HEALD MACHINE CO.
WORCESTER 6, MASS.

PRECISION TURNING AUTOMOTIVE DISTRIBUTOR CAMS

With a high rate of production required, and tolerances limited to .0005, there was a need for Heald Precisioneering. Solution: on a Heald No. 48A Bore-Matic the shoulder was turned to .8740 O.D.—two at a time. Resulting production was four times greater than that turned out on a bench lathe.

HEALD *for more Precision ... Faster!*

Internal and Surface Grinding Machines • Bore-Matic Precision Finishing Machines

M-4 MILITARY TRACTOR — Powered by WAUKESHA ENGINE—Co-operating with the Army Ordnance Department, Allis-Chalmers Tractor Division designed and is building M-4 Military Tractors. The power plant, a Model 145-GZ Waukesha Engine, was designed and is built by Waukesha Motor Company.

NOT MEN AND MULES . . . BUT

WAUKESHA

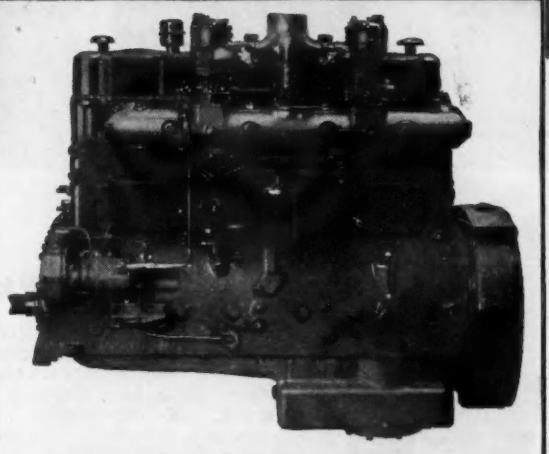
HORSEPOWER

HAULS HEAVY GUNS INTO ACTION

The motive power of men and mules that once hauled artillery isn't fast enough for this war. To get there *first* with superior fire power, our Field, Coast and Anti-aircraft Artillery must move faster . . . *and faster!*

Neither shell holes nor ditches, muck, mud nor mountains stop the new track-laying M-4 Military Tractors from moving the heaviest guns into position. Powered with Model 145-GZ Waukesha Engines, they have all the pulling power of a track-type tractor plus the smooth eager speed of a truck.

This is a wartime Waukesha Engine . . . a special development for combat service in heavy ordnance equipment . . . a super power plant built by Waukesha to out-power and out-perform any similar engine of the same size ever produced!



MODEL 145-GZ WAUKESHA ENGINE

Six cylinders, 5⅜ in. bore x 6 in. stroke, 817 cu. in. displ. Burns gasoline . . . is designed to use modern aviation fuels . . . develops high output. And it's really rugged! Crankcase and cylinder block cast as a single unit. Crankshaft is drop-forged steel, heat treated. Wet sleeve cylinders easy to remove and replace. Positive pressure oiling with built-in oil cooler. Thermostatic by-pass system maintains efficient operating temperatures, and assures quick warm-up when starting.

Right now all Waukesha production is for war work. After the war is won, peacetime Waukesha Engines will be ready for all your special requirements. Consult Waukesha engineers now about your future engine needs.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
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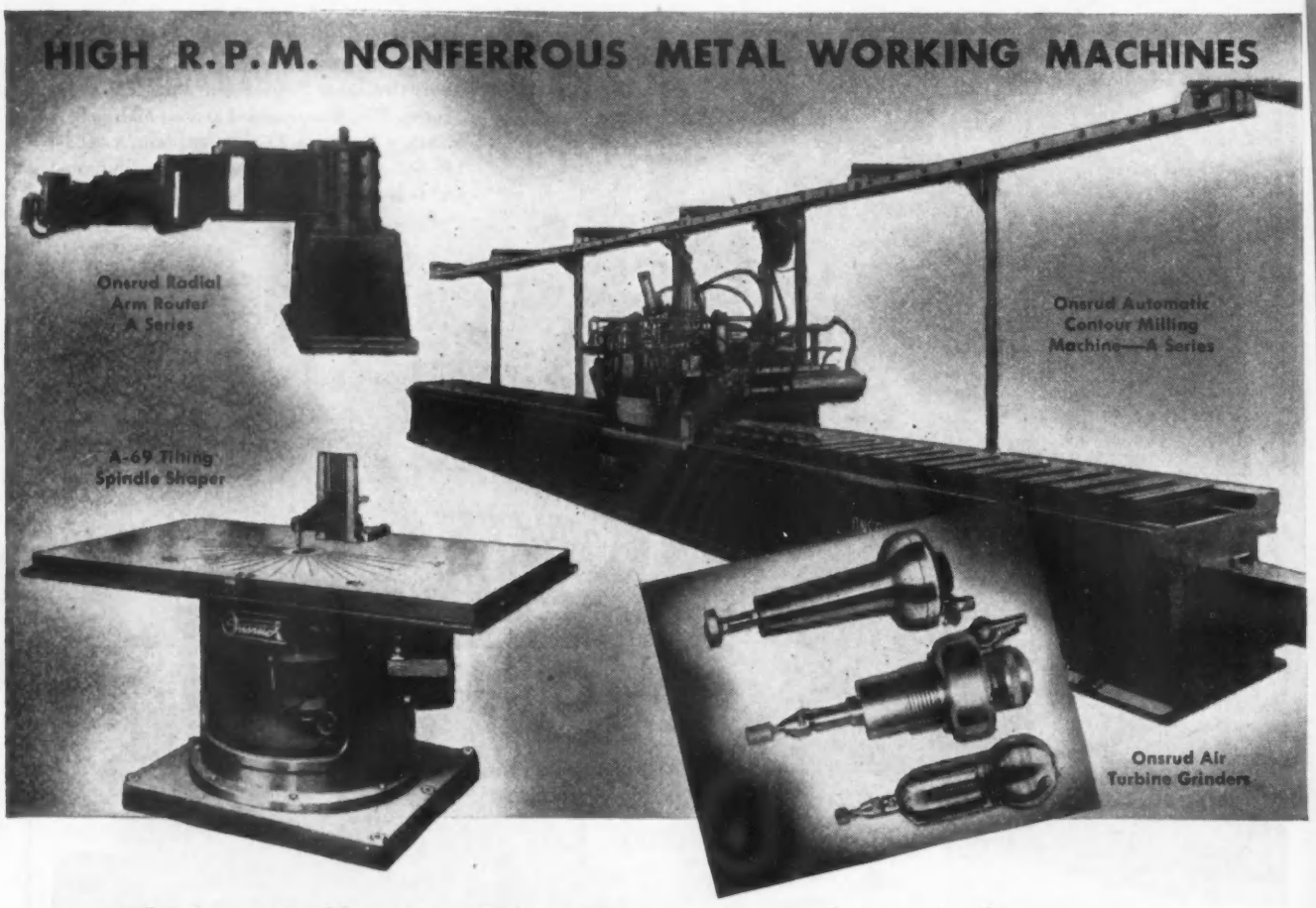
MORE POWER FOR VICTORY

WAUKESHA ENGINES

HIGH R.P.M. NONFERROUS METAL WORKING MACHINES


Onsrud Radial Arm Router A Series
Onsrud Automatic Contour Milling Machine—A Series
A-69 Tilting Spindle Shaper
Onsrud Air Turbine Grinders

These Bulletins Give You Complete Information

If you've been wanting complete information on the high speed machines that the metalworking publications have been writing about recently, take advantage of this Onsrud offer. Write for the machine bulletins described below. Some of these machines, of course, were designed specifically for aluminum alloy aircraft parts production. But the principles involved in machine design apply in all industries — wherever the light metals must be machined. It may prove of considerable advantage to you to have this data now.

MILLING

This gives the facts about Onsrud Automatic Contour Milling Machines. Extruded wing spars, some as long as 50 feet, are milled in a matter of minutes. Four cutter motor assemblies on a traveling carriage make numerous types of milling cuts—face, slot, twist and taper, as well as cut-outs.

ROUTING

How would you plan the job of cutting out to exact size and shape a production run of parts from flat sheet stock? Large Onsrud Radial Arm Routers cut or rout work from single nonferrous flat sheets up to 4′ x 12′ in size. Router bits are direct high cycle motor driven at 15,000 RPM. Machines like these, with drill heads, perform drilling operations under a similar procedure.

SHAPING

Actually a type of milling machine, the cutter of the Onsrud A-69 Shaper may be set at any off-vertical angle up to 20° toward either the front or back of the machine. Used for beveling as well as trimming channels and similar parts. Cutters turn at 10,800 RPM.

GRINDING

Onsrud air turbine Grinders have spindle speeds ranging from 38,000 to 75,000 RPM. These are successfully used on all types of materials. The wide range of high speeds provides the proper speed for even grinding wheels below ¼" diameter. Units like this are machine mounted for such operations as precision die grinding.

Write for bulletins today. Manufacturers with present or contemplated production problems involving the machining of nonferrous metal alloys or related materials are invited to write to Onsrud for information and assistance now.

ONSRUD MACHINE WORKS, INC.
3925 Palmer Street, Chicago 47, Illinois
Sales Offices in All Principal Cities

MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

AUTOMOTIVE and Aviation INDUSTRIES

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CONTENTS

A Plan for Unemployment Compensation During Reconversion. *By Col. Willard F. Rockwell* 17

Strong Enterprise System Essential for Postwar Recovery. *By J. R. Custer* 18

Little Detroit in New Guinea 21

Anderson Aluminum Forge Plant Fourth Unit of Chevrolet System. *By Joseph Geschelin* 22

Notes on Magnesium Alloy in Design. *By R. O. Brittan* 26

Progress in Diesel Field 30

Aircraft Heating Systems of Three Types. *By Wilbur W. Reaser* 32

Cylinder Arrangement for 4000 Hp. Aircraft Engines (Part One) 36

Airbriefs 44

Dealers Franchises Stage Comeback—*By E. L. Warner, Jr.* 46

News of the Industry 43

Calendar of Coming Events 52

New Products for Aircraft 70

New Products 78

New Production Equipment 83

Advertisers' Index 212

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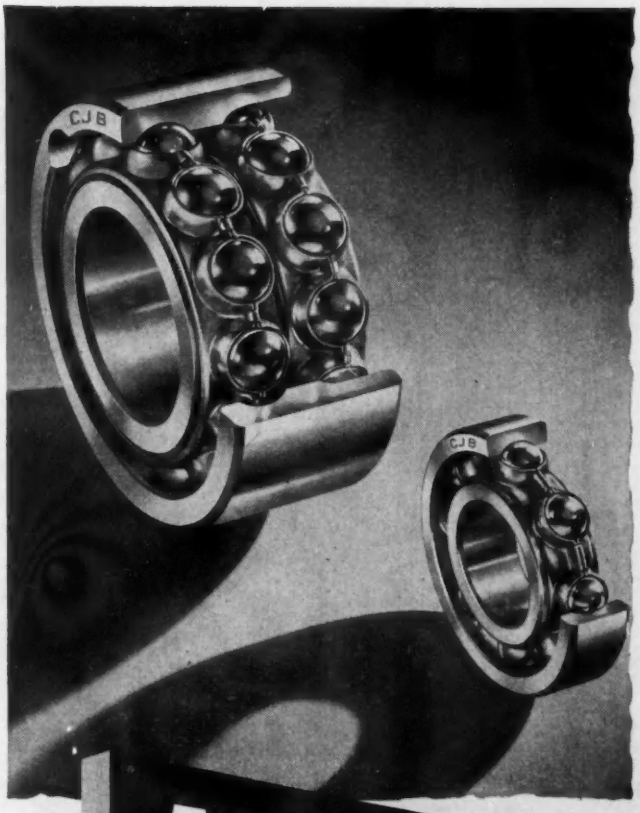


AN IDEA *that goes on and on*

THERE is much said these days about "Change"—about new ideas, new methods, new products ready to make the world a better place for living.

There is one "old" idea that goes on and on—it's eternally good and permanently practical:—the traditional zeal for perfection symbolized by every CJB Ball Bearing.

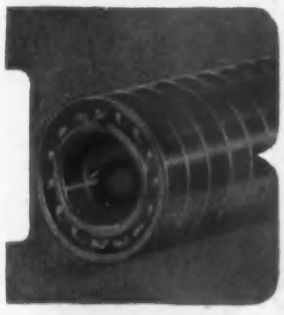
From 22 branches CJB engineering service is available to help you on immediate bearing problems.

AHLBERG BEARING COMPANY
3002 W. 47th STREET • CHICAGO, ILL.

CJB BALL BEARINGS

AUTOMOTIVE *and* AVIATION INDUSTRIES. Vol. 90, No. 12. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

Like a mirror



BALL BEARINGS MUST BE KEPT *Bright and Shiny*

PROTECT BALL BEARINGS FROM CORROSION WITH

NOX-RUST No. 102-BC or NOX-RUST No. 402-C

The Master Rust Preventive

Ball bearings stored domestically or shipped overseas need protection against corrosion. These two NOX-RUST products have been developed for this specific purpose . . . NOX-RUST No. 102-BC for hot-dip rust prevention and No. 402-C for those preferring an oil-type rust preventive. Both are highly resistant to oxidation and furnish maximum protection in atmospheres of high humidity at high temperatures.

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Bundy Double Flare

TWICE the amount of metal at the seat.
PERMITS frequent making and breaking of joint without damage to flare.
SAFELY permits over-torqueing.
MADE BY HAND or with machine tools.

Provides Leakproof, Pressure Proof Joints

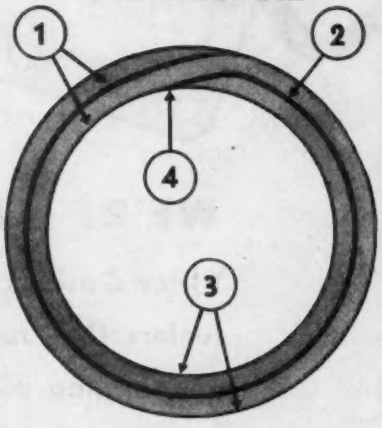
A "Natural" Teammate with Bundyweld
THE SOLID DOUBLE WALL STEEL TUBE

In hydraulic brake lines and in all lines where there may be over-torqueing or where higher pressures are carried, Bundy recommends Bundyweld Tubing and the Bundy double flare — a combination which assures leak-proof, pressure proof joints.

Bundyweld is a SOLID double walled tube laterally rolled from a single strip of copper-coated S.A.E. 1010 steel. Bonded with copper throughout the 360° of wall contact . . . brazed in a furnace where the atmosphere is carefully controlled to prevent oxides and to provide a clean, bright finish inside and outside . . . this unique tubing is made by an exclusive Bundy process. It is furnished hard or annealed in a wide range of standard diameters and gauges up to ⅜" O.D. Special sizes, cold drawn as desired.

For further information on Bundyweld, write Bundy Tubing Company, Detroit 13, Michigan . . . our engineers are ready to help you solve your tubing problems in war and peacetime products.

Look at Bundyweld Construction!



1. DOUBLE WALL
2. COPPER BRAZED
3. COPPER COATED inside and outside
4. NO INSIDE BEAD

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ENGINEERED TO YOUR EXPECTATIONS

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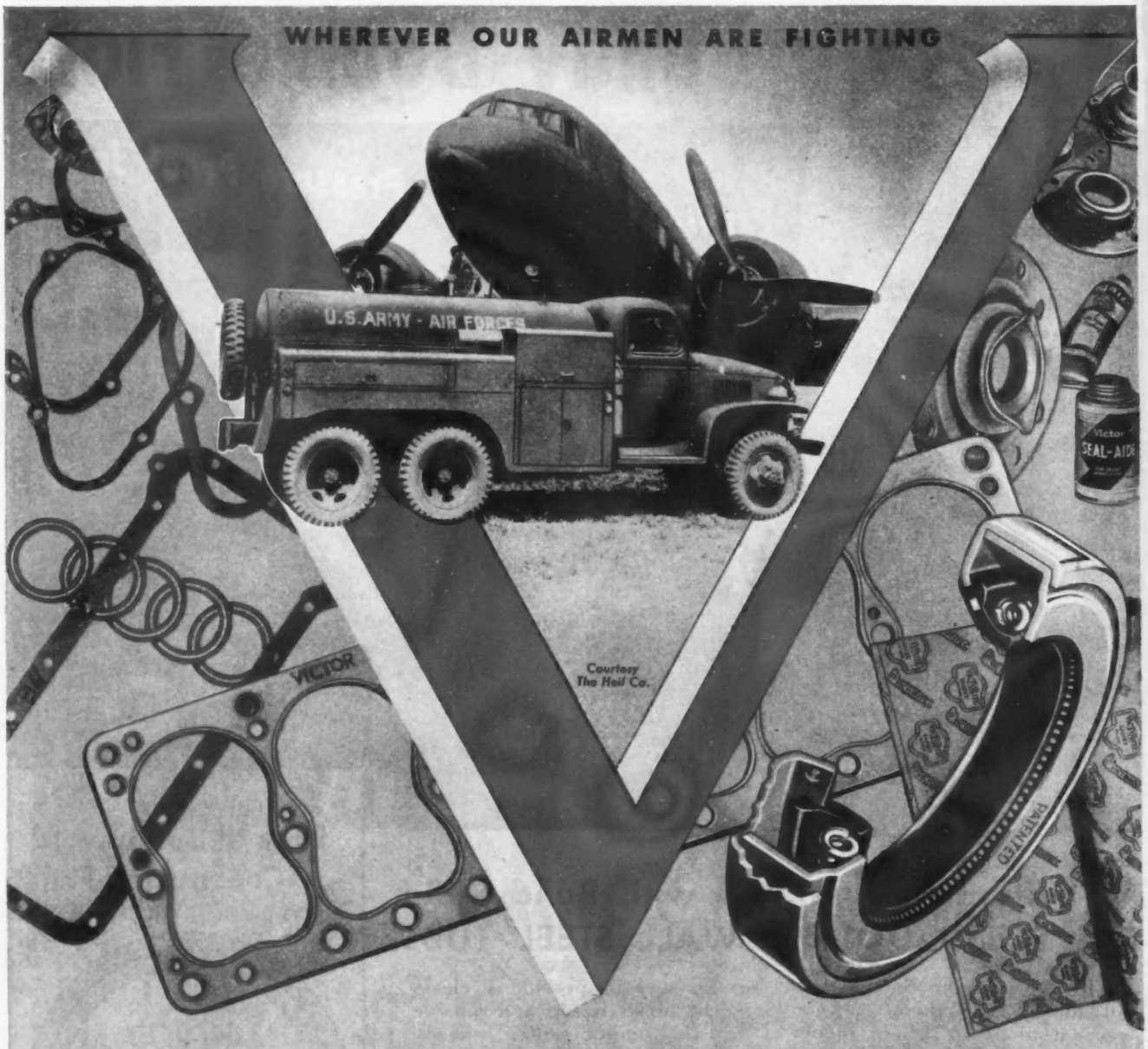


WE'RE HELPING TO KEEP 'EM FLYING

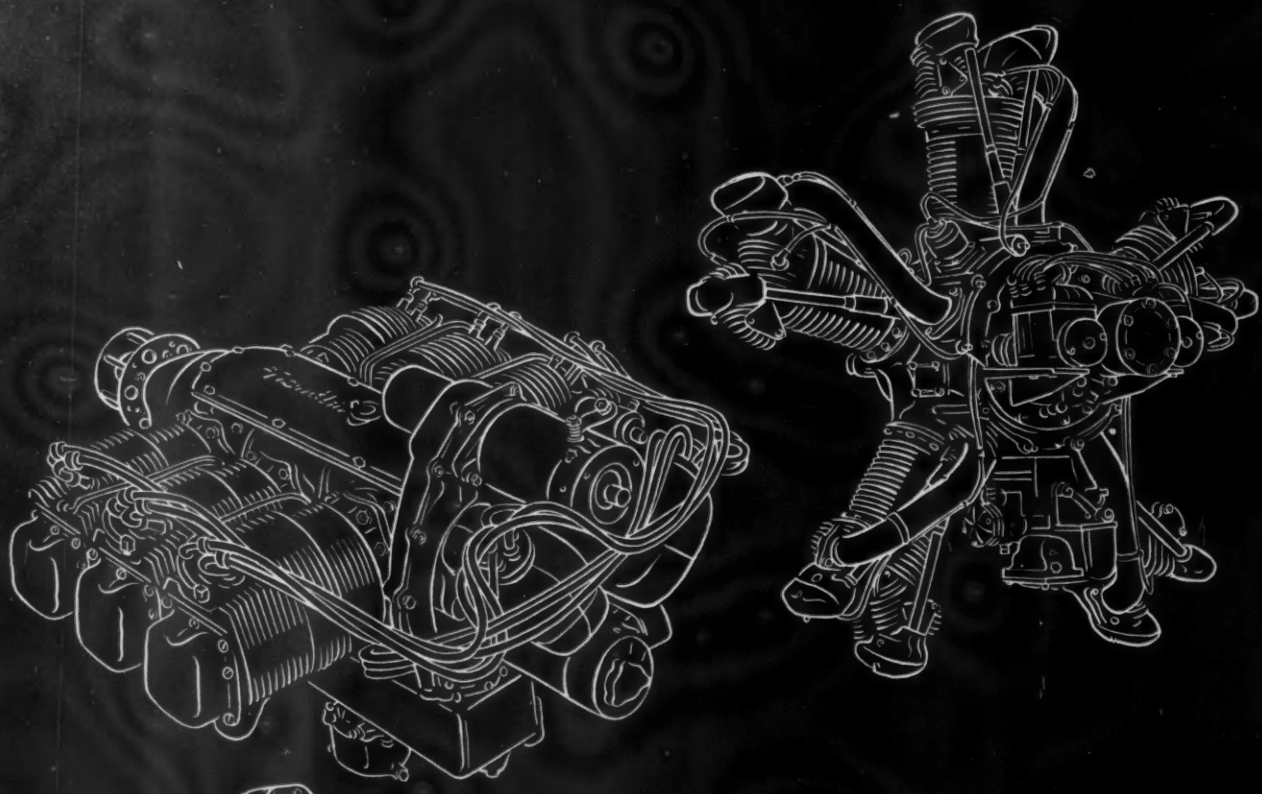
Victor Gaskets are standard equipment on combat aircraft refuelers that rush high octane gasoline and lubricating oil to our fighting planes as they land, sometimes under fire, on front line airstrips throughout the world.

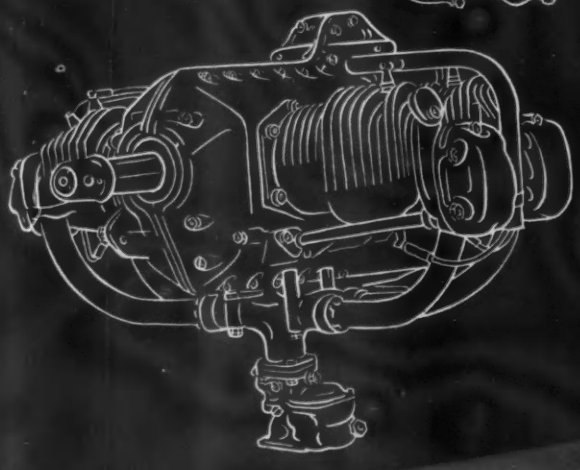
Victor Manufacturing and Gasket Co., P. O. Box 1333, Chicago, Ill., U. S. A.

VICTOR

GASKETS · · OIL SEALS

WHAT IS THE FUTURE OF AIR COOLING?





Will automotive vehicles of the future be powered with air-cooled engines?

Are there features of air-cooling—such as improved horsepower-weight ratio and easier adaptability to underneath or rear location—that may become important in achieving vehicle design objectives? Knowledge gained from the advancements in the cooling of military aircraft and tank engines may well contribute greatly to the development of air-cooled automotive engines.

The problem of engineering an air-cooled automotive power plant includes many questions of parts design. Piston rings, for example, may have to be reconsidered.

Muskegon's experience in designing and producing piston rings for all types of engines—air-cooled or liquid-cooled—is available to all engine manufacturers. Consult Muskegon engineers and metallurgists freely.

DOUBLE War Bond Purchases NOW!

MUSKEGON
Piston Rings

MUSKEGON PISTON RING CO.

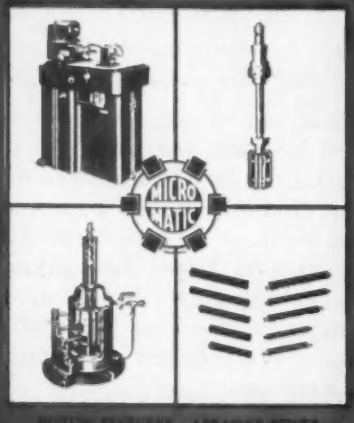
MUSKEGON, MICHIGAN

PLANTS AT MUSKEGON AND SPARTA

Honing shared in converting yesterday's "PRIDE OF THE FLEET" into the MODERN ECONOMICAL TRUCK CARRIER

Yesterday—Called "slave ships" and "kidney busters" by drivers, yesterday's trucks were hard to drive, costly to operate, and required almost constant service. But with all their crudities, they inaugurated a new era in highway transportation and distribution of goods. Considered an early process of controlled abrading—made them possible.

Today—The powerful modern carrier has higher speed, maximum economy, long periods between overhauls, easy maintenance, a high payload factor—the goal of yesterday's builders. HONING, the modern, controlled abrading process, helped engineering design and production achieve this mechanical triumph.



Tomorrow—Today's tough military service and maintenance will be projected rapidly into commercial and industrial use. The competitive movement of bulk-weight shipments will require greater and greater operating efficiency.

In the mechanical refinements to come, HONE ABRADING processes developed by Micromatic will be ready to play a most important part.

MICROMATIC
HONE CORPORATION
Detroit, Michigan

MAKERS OF HONING MACHINE TOOLS

Army Transport Now Races
On Honed Working Surfaces

Only yesterday army trucks crawled briefly between breakdowns—because of poor bearing surfaces. Modern carriers—trucks, tankers and prime movers have to be tough to stand the continuous service under heavy going.

They now race dependably on accurately honed working surfaces. Speed and runs between overhaul have been multiplied. They are better because of their precision bearing surfaces. Honing assures this surface quality, and eliminates loose bearings, inaccurate bits, fatigue cracks, and other enemies of durability.

Microhoning—the modern abrading process—removes stock at rates up to 65 cubic inches per hour—generates accuracy for roundness and straightness of bore within .0002" to .0003" and any desired surface finish.

Trucks—planes—tanks—jeeps—ordnance—ships—Microhoning has many applications in war . . . and many more in peacetime use. Write for Bulletin A. R. 67.

Some Microhoned Heavy Vehicle Bores

Gas and Diesel Engine Cylinder Bores and Sleeves

Connecting Rod Bores (Large End)

Valve Guide Bores

Diesel Fuel Injector Bores

Shock Absorber Bores

Brake Cylinder Bores

Transmission Gear Bores

Ditching Machine Planet Gear Bores

Roller Tooth Steering Sectors and many other parts.

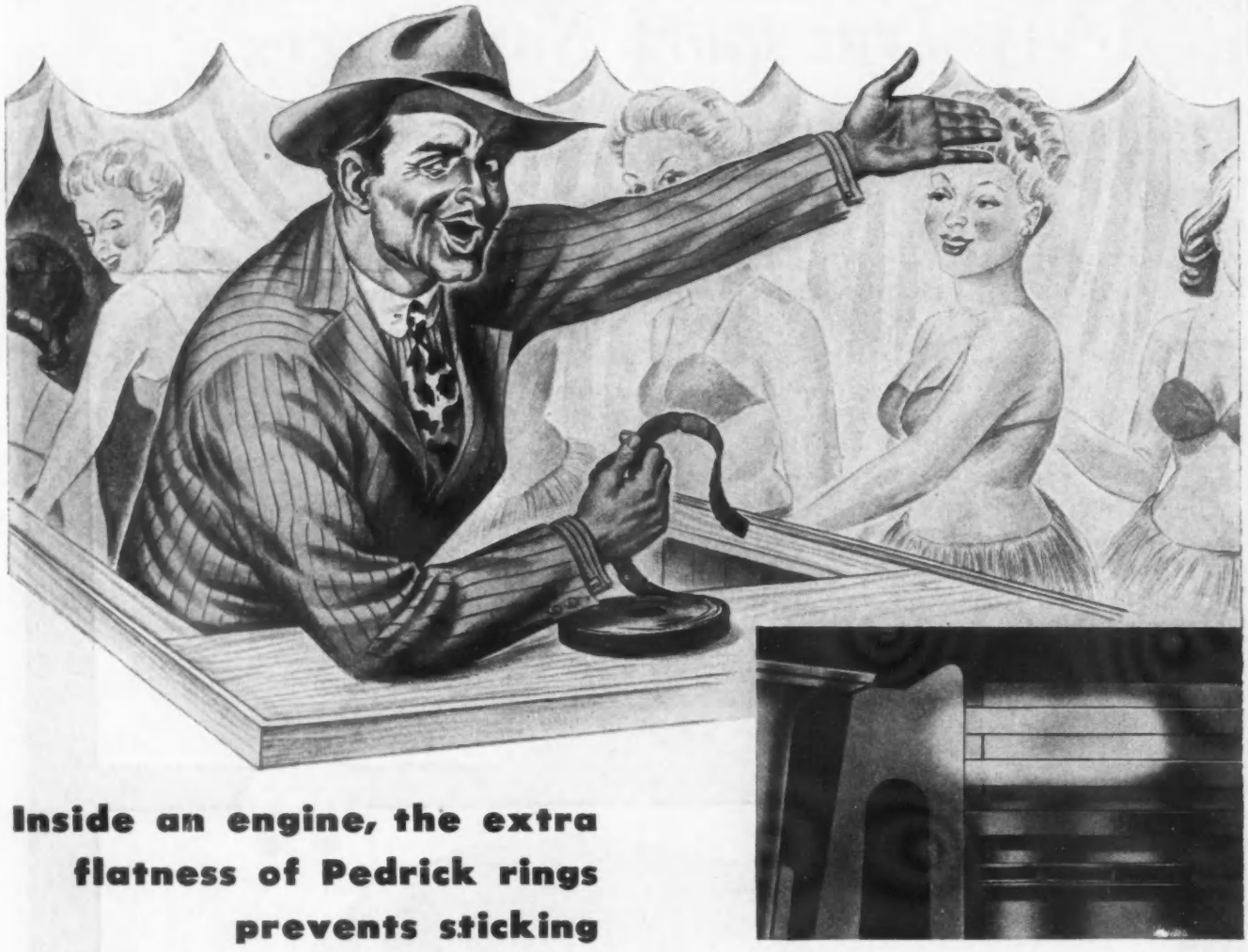
MICRO MATIC

"Courtesy Mack Truck, Inc."

MICROMATIC HONE CORPORATION

DETROIT, MICHIGAN

It's what goes on INSIDE *that counts*



Inside an engine, the extra flatness of Pedrick rings prevents sticking

INCREASED gas and oil consumption . . . less power . . . greater wear . . . shorter time between overhauls—these are troubles caused by rings that haven't a sufficient degree of flatness. They stick in the piston grooves and are no longer able to give proper seal.

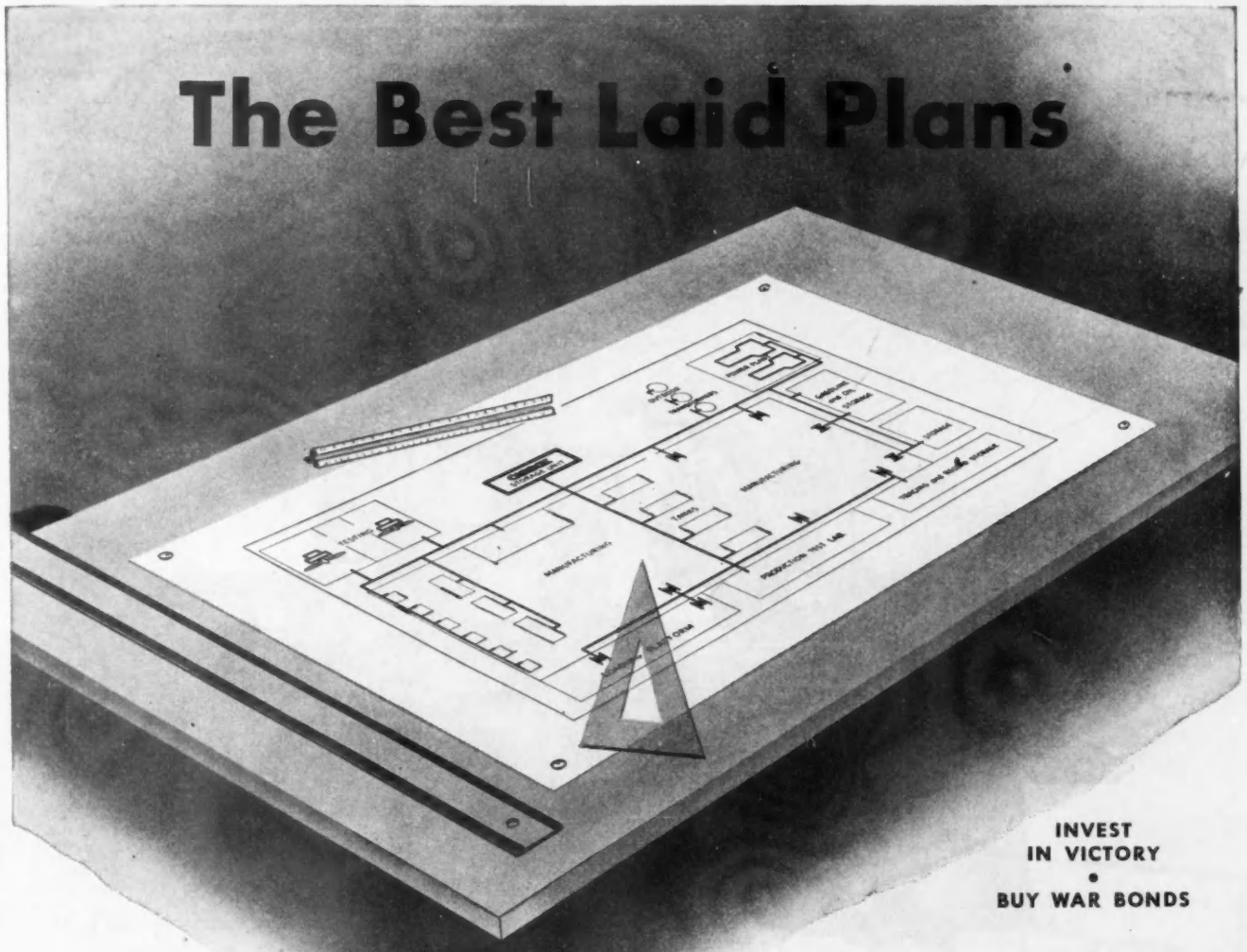
Pedrick's double-disk, lap-grinding process makes rings so flat that those as small as 2 inches in diameter can be stacked 6 feet high without tottering! And they *stay* flat, too, because the exclusive Pedrick method of Heat-Shaping relieves the stresses set up in the metal from machining operations. Each grain in the metal is set for life, preventing warping at high speeds.

The wide acceptance of Pedrick rings by industry, for both original equipment and replacements in all kinds of engines, compressors, pumps, and hydraulic equipment, is the direct result of high performance and long life under actual service conditions. Pedrick *precisioneered* rings are made in all types and sizes up to 36″ in diameter. Write today for the complete story on Pedrick *precisioneering*. WILKENING MANUFACTURING Co., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

BOND DAY IS EVERY DAY . . .
KEEP BUYING

Pedrick

precisioneered **PISTON RINGS**



Include FIRE PROTECTION by CARDOX

War has taught many lessons. One, for example, that merits high rating on any planning program is this: ENGINEERED VICTORY over production can be lost without an engineering victory over fire!

Whether your planning is concerned with war production, conversion, or utilization of new processes, an individually engineered Cardox Fire Extinguishing System offers many distinct advantages for protecting critical fire hazards.

CARDOX PROTECTION COVERS A WIDE VARIETY OF INDOOR AND OUTDOOR HAZARDS

Installed to protect one or many manufacturing operations, a Cardox System can provide means of detecting fires in such places as areas where flammable liquids are processed, used or handled . . . around electrical equipment or at any of a wide variety of key hazards where one fire could stop all production.

HOW CARDOX SYSTEMS PERFORM

Fire in any of these hazards is detected visually or automatically.

An alarm sounds, giving personal notice to leave the fire zone. Time is allowed for complete evacuation of personnel.

A timed mass discharge of non-damaging, non-contaminating cold Cardox CO_2, released into the fire zone, reduces oxygen content of the atmosphere below combustion requirements and cools out the entire fire. Cardox CO_2—in pounds or tons, as required—is discharged into the fire so rapidly that burning time is usually cut to a very few seconds.

Extinguishment of this kind is possible with a Cardox System through engineered application of carbon dioxide maintained at a standard storage temperature of 0° F. The advantage of uniform extinguishing performance can thus be provided indoors or out . . . for large or small fires . . . for one or a number of hazards.

If you would like more information for use in solving current war plant fire protection problems—or for consideration in connection with post-war planning—write for Bulletin 464.

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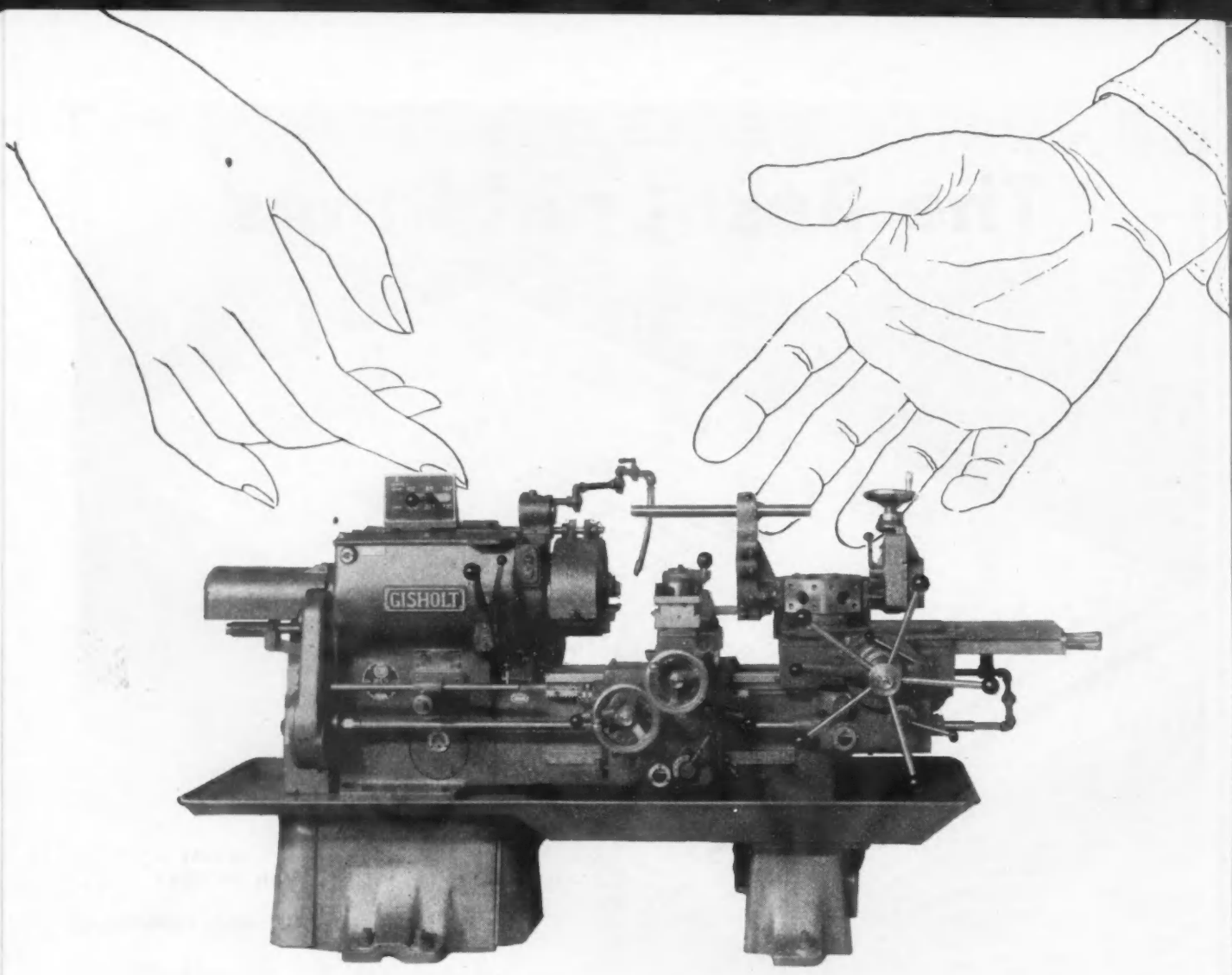
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS



This Postwar Improvement Couldn't Wait

Hydraulic Clutching and Braking. With this new Gisholt improvement comes ease in starting, stopping and reversing the spindle. It puts an end to tugging at levers, to fatigue. The only physical effort required to engage clutches is a mere flick of the hand on the hydraulic control—to right or left. In neutral position, automatic spindle braking brings the work to a quick, smooth stop.

Why save an important improvement like this for postwar announcement? It's needed *now* to speed up war production. It's available *now,* as standard equipment, on all Gisholt Ram Type Turret Lathes. If you'd like more detailed information, write us.

GISHOLT MACHINE COMPANY
1205 East Washington Avenue • Madison, Wisconsin

GISHOLT

...Look Ahead...Keep Ahead...With Gisholt

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

THE GIANT TORTOISE, believed to outlive all vertebrae. Its usual life span is up to 100 years, but records show one to have been at last 152 years old and possibly 200.

STANDARD OF STAMINA

What you want most in a capacitor is what you are sure of getting in TOBE Capacitors: . . . *long life!* Your proof is in Tobe's enviable record of practically no "returns". Frequent, rigid inspections eliminate uncertainty. Constant research brings constant improvement. The original capacitor with hold-down bracket, Tobe OM-601, offers many definite advantages. This capacitor is strong, compact and space-saving. The hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. Write for details and samples (1.0 mfd and 2.0 mfd). Tobe engineers are glad to be of service.

This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.

LONG LIFE ASSURED!

SPECIFICATIONS TOBE OM-601 CAPACITORS

TYPE . . . . . OM
RATINGS .05 to 2.0 mfd. 600 V. D. C.
.05 mfd. to 1.0 mfd. 1,000 V. D. C.
STANDARD CAPACITY TOLERANCE . . . 10%
TEST VOLTAGE . . . Twice D. C. rating
GROUND TEST . . . 2,500 Volts, D. C.
OPERATING TEMPERATURE . . 55°F to 185°F
MOUNTING HOLE CENTERS . . . . . 1½"

SHUNT RESISTANCE
.05 to 0.1 mfd. 20,000 megohms
.25 to 0.5 mfd. 12,000 megohms
1.0 to 2.0 mfd. 12,000 megohms
POWER FACTOR
At 1,000 cycles—.002 to .005
CONTAINER SIZE
Width ⅜", length 1 5/16", ht. 2¼"

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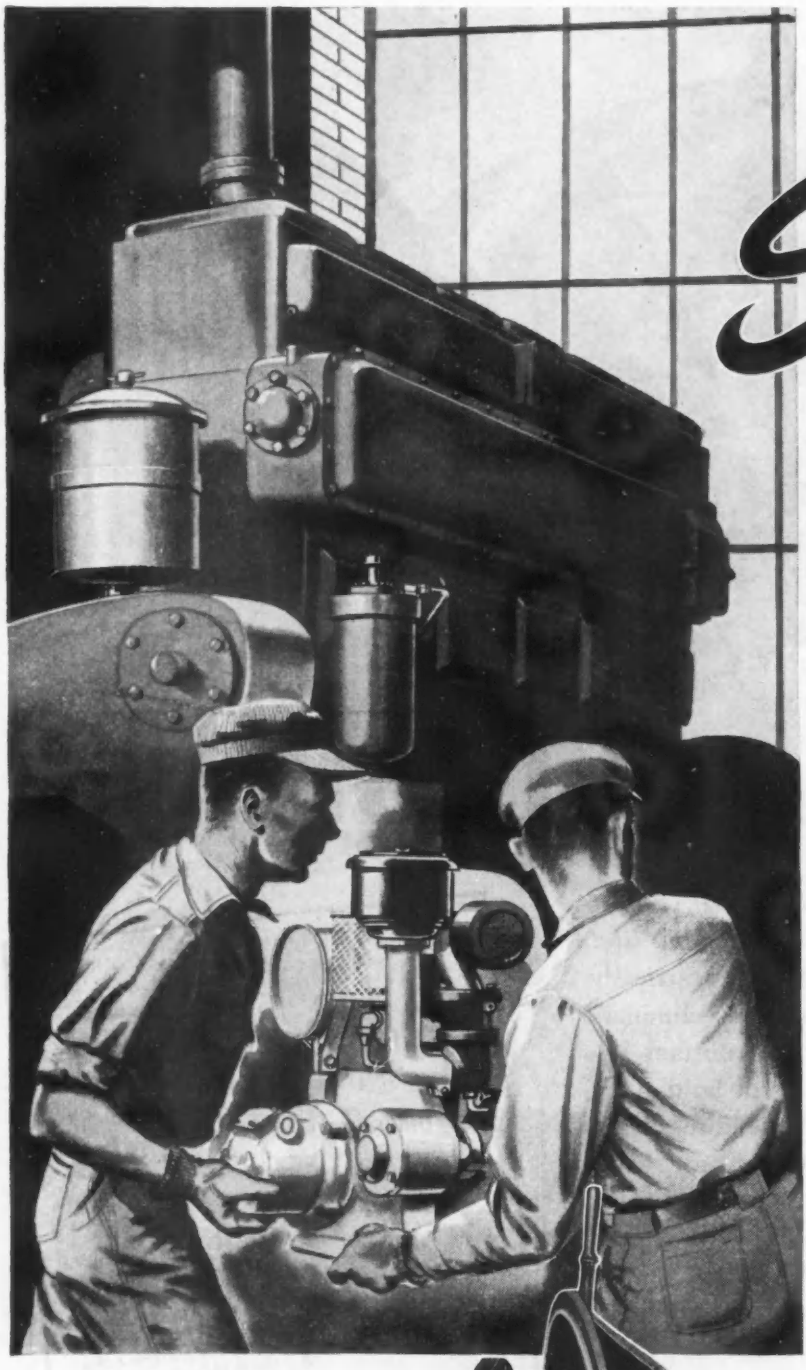
A small part in Victory Today . . **A BIG PART IN INDUSTRY TOMORROW**



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There's a note of challenge in the deep-throated roar of a huge diesel engine—in the staccato bark of a two-cylinder, air cooled gasoline midget. It's a note of defiance inherited from men who build engines to do impossible jobs—jobs far beyond the power of man's muscles.

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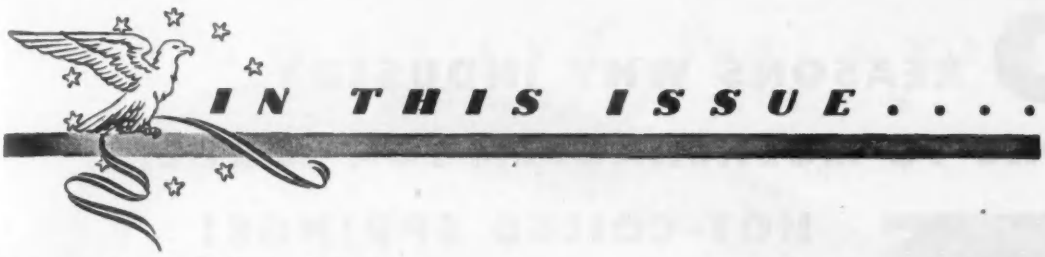
As a user or builder of equipment involving driving and driven units, you will find it profitable to get in touch with the Twin Disc Clutch Company. Because we are builders of both friction clutches and hydraulic drives, we can offer *complete* answers to power link problems. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Twin Disc Power Take-offs enable one engine to do many different jobs. Smooth operating, heavy-duty friction clutches, enclosed in housings, deliver full engine torque and horsepower.



AUTOMOTIVE
and AVIATION
INDUSTRIES

Volume 90 June 15, 1944 Number 12

Unemployment Compensation During Reconversion 17

The whole country is looking ahead to peace-time living. Plans for getting back to normal are of particular interest and importance at this time. Here is something from an author that really commands attention. It would be a mistake to pass by this discussion by Col. Willard F. Rockwell.

Anderson Aluminum Forge Plant 22

When an organization delivers 76 million pounds of aluminum forgings for the war effort "just how it ticks" is of interest and instructive value. This is a description of the fourth Chevrolet unit of this type. It shows and tells all.

Notes on Magnesium Alloy In Design 26

The author begins this article with an observation that "although a considerable quantity of data on the mechanical properties of magnesium alloys is available, information on this subject is by no means complete." He then goes on and gives a wealth of information derived from experiences of the Northrup aircraft plant. Well illustrated and most revealing.

Aircraft Heating Systems 32

This subject has come to the forefront for a great deal of attention recently. It is one of the ripe questions of the day. In this treatise three systems are discussed in a most informative manner and illustrated by drawings that efficiently augment the text.

Cylinder Arrangement for 4000 Hp. Aircraft Engines 36

This is the translation and adaptation of an article that has appeared in a German technical publication and will be found interesting and instructive.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Leadership

By Julian Chase

FOR its fullest possible development to the greatest long-time good for all, any system of government in which the power of action or decision in national affairs rests with the mass of the people must have, as a prime essential, informed, intelligent and intellectually honest leadership. The founders of America knew that and set up what they thought were reasonable assurances of getting it. But they discounted the power of the politician. They underrated the influence of the demagogue. They obviously could not have comprehended the possibility of such a decline in the quality and caliber of our elected leaders as even those of us now living have seen. And most assuredly they could not have visualized a decline such as has occurred since their time.

Where are the Jeffersons, the Madisons, the Clays, the Lincolns, the Websters today? What has become of principle as an inflexible guide to utterance and to action?

Among our present dominant political leaders, these are the days of empty but vote-making promises, of meaningless generalities which seem to propose the attainment of the unattainable. These are the days of diametrical opposition between saying and doing, of running on one platform and standing on another and radically different one after election. These are the days of the quip and the slogan, which prove nothing and offer too much.

These are the times in which a leading Senator, who has passionately proclaimed that the approval of his own conscience and self-respect are more precious to him than any honors that might be bestowed, can advocate first a third term and then a fourth term for a President, to whose party he happens to belong, after having voted for a Senate resolution which declared that "*any* departure from this time honored custom (two terms only) would be unwise, unpatriotic, and *fraught with peril to our free institutions.*"

Whatever our attitude toward a fourth term may be, whether we are for it or against it, whether we are Democrats or Republicans, what should be our attitude toward such a man of whatever party? That is a crucial question. It applies not by any means to one man alone. It may well be applied to any, from the highest to the lowest, of those who set themselves up in a position of political leadership. It

(*Turn to page 92, please*)

5 REASONS WHY INDUSTRY LOOKS TO MUEHLHAUSEN FOR LARGE, HOT-COILED SPRINGS!

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

June 15, 1944
Vol. 90, No. 12

A Plan for Unemployment Compensation *During* Reconversion

By Col. Willard F. Rockwell

THIS program is presented as a contribution to postwar planning. It is designed to promote a measure of security for both labor and industry in the economic upheaval that will follow contract terminations.

Industry has already experienced "cut-backs," or readjustments in the war production program. The disruptions these produce are indicative. Probably sooner than is realized, readjustments will become everyday practice as military requirements diminish. The period between a whole or substantial cancellation of war contracts and the resumption of production for civilian use is fraught with danger for both labor and industry. Millions of employes will be thrown out of work for varying periods of time.

Under the present method of excess profit controls, it is made exceedingly difficult to establish reserves for maintenance of employment during the period of reconversion. Nor has there been any practical provision set up to enable industry to absorb returning military personnel and at the same time continue to employ those now on the payroll. It is absolutely imperative that we recognize this problem and take some immediate steps if we are to avoid the disastrous consequences that must follow our failure to provide a workable solution before the actuality is upon both labor and industry. The following program is submitted with the thought that it is at least based upon considerations of practicality.

1. Every company engaged in whole or substantial part with war production, be permitted to withhold from 1943-1944 and 1945 gross income after taxes and normal profit, and before renegotiation, a sum up to the equal of one average week's wage or salary for each month of continuous employment of each person on the payroll, with a maximum total equal to 24 weeks' wage or salary for employes who have worked two years or more.

2. Based upon the same formula, an equal sum to be withheld for each ex-employe now serving in the armed forces, with the same maximum and minimum withholdings operative.

3. These funds shall be held by each company. A complete record of such withholdings, together with the record of each active employe, plus those serving in the armed forces, shall be sent to the Social Security Board. Payments out of the fund shall also be recorded with the Social Security Board. These records shall be available to the public.

4. Disbursements of these funds to unemployed workers will start at the time of complete cancellation of war contracts. Or in the instance of graduated contract cancellations due to readjustments in the war production program, a joint labor-management committee in each plant shall determine the mutually satisfactory point at which disbursements shall start. In the case of ex-employes returning from the armed forces, payment shall start upon personal application of each ex-employee. *Turn to page* 100, *please*)

Col. Rockwell, the author of this plan, is chairman of the boards of the Timken-Detroit Axle Co., Timken Silent Automatic Co., Standard Steel Spring Co., Pittsburgh Equitable Meter Co., Merco-Nordstrom Valve Co., H. A. Smith Machine Co., Meter Parts Co., Muehlhausen Spring Co., National Meter Co., Inc., and chairman and president of the Hupp Motor Car Corp. He is also a director in the American Mutual Liability Insurance Co. of Boston, Commercial National Bank and Trust Co. of New York, Coal Operators Casualty Co., First National Bank of Pittsburgh, Peoples-Pittsburgh Trust Co.

He was Director of Production of the U. S. Maritime Commission from April, 1942, until his resignation on December 31, 1943. At the present time he is Vice-Chairman of the Industry Associations Committee of the War Manpower Commission. He was a member of the Executive Committee of the Army and Navy Munitions Board and of the Material Requirements Committee of the War Production Board.

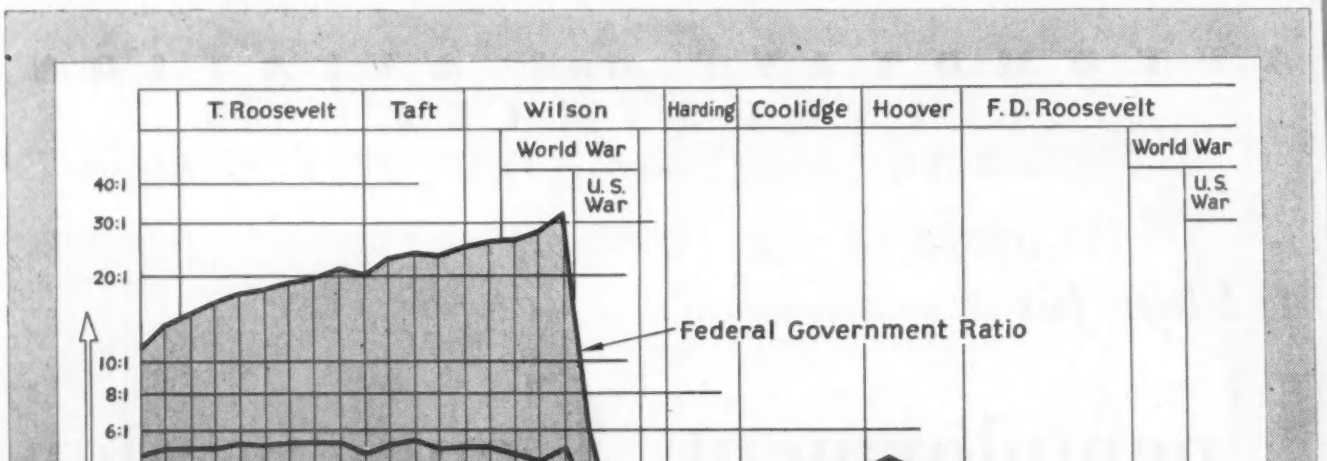


Fig. 1—Barometric Chart of United States Economy.

Strong Enterprise *System* Essential

THE economic dislocations precipitated during war obviously are extended in varying degrees into the years following. Especially has modern warfare with its world-wide scope intensified this condition, so much so that the present conflict is ominous in that respect. For with two world upheavals only 20 years apart, and this nation the "arsenal" for each, significant economic changes have developed in this country during the interlude between them.

The marvel of all history is the patience with which men and women submit to burdens unnecessarily laid upon them by their government.
—William H. Borah

It is the period between 1920 and 1940 with which we are concerned here, because during it there has taken place a reversal of basic principles through the increasing activity of the Federal government in the nation's economy and its enlargement from a purely regulatory factor to an active agency embracing functions of directive control by bureaus and by large-scale support. A review of the development of America under the system of free enterprise, on a governmental regulatory basis, substantiates the appraisal of that trend as being in the wrong direction into state socialism. The naturally developing outcome in countries having governmental domination of their economic systems is further evidence of the futility of such a public policy.

For this analysis we are using a non-quantitative number — the ratio of National Income and governmental debt—as a basic concept of the trend of the over-all economy in the United States. National Income presently being considered (National Income Paid Out) represents the total amount of money received each year by individuals in the form of salaries, wages, interest, dividends, net rents, pensions, social security and relief benefits, royalties, etc. Sources of these data and others contained in this article are listed at the end.

Figs. 1 and 2 show the trend of National Income

By J. R. Custer

and governmental debts, their ratios, and long-term private debts from 1900 to 1943. A few critical data are available for the period previous to that time. The impact of the Civil War resulted in a sharp drop of the National Income-Federal debt ratio from approximately 70:1 to about 2.5:1, where it was immediately after World War I. During the 25 years following the Civil War the Federal debt was reduced from $2.75 billions to $1.0 billion, after which it remained almost constant at slightly over the $1.0 billion mark until 1916. During those 50 years, the annual National Income increased about $32 billions.

Recall the principle of President Cleveland that it is the business of the people to support the government, not of the government to support the people. —*Calvin Coolidge*

As shown in Fig. 1, the United States began the Twentieth Century with the relation of National Income and governmental debt considerably improved. From 1900 to 1916 the Federal debt remained unchanged at approximately $1.2 billions while State-Local governmental debt increased from $2 to $6 billions, which was offset by a National Income gain from $16.2 billions to $38.7 billions. The war years of 1917-18 with huge Federal government expenditures sent the National Income-Federal debt ratio from 31.6:1 down to 2.5:1.

Then followed the contradictory Twenties and Thirties, which were similar in that each period began with a depression, but different in economic conditions and Federal government fiscal policies. During the Twenties the Federal debt was reduced from an all-time high of $26.6 billions, but as State and Local governmental debts increased by about the same amount, the total governmental (Federal, State, Local) debt continued unchanged until 1931.

It was during the Twenties that governmental policy enabled the enterprise system of the country to thrive and produce a continued growth of National Income, the upswing of National Income-Federal debt reaching 5:1 in 1929. Ten years after the Civil War it was at the 3.3:1 mark.

The prosperity of the Twenties with their full employment was made possible chiefly by the expansion of new industries, including the automobile, radio, household electrical appliances and equipment, and aviation. Unfortunately, despite this postwar recovery, two negative factors existed that ultimately contributed to the 1929 collapse. Some industries — agriculture, bituminous coal

for Postwar Recovery

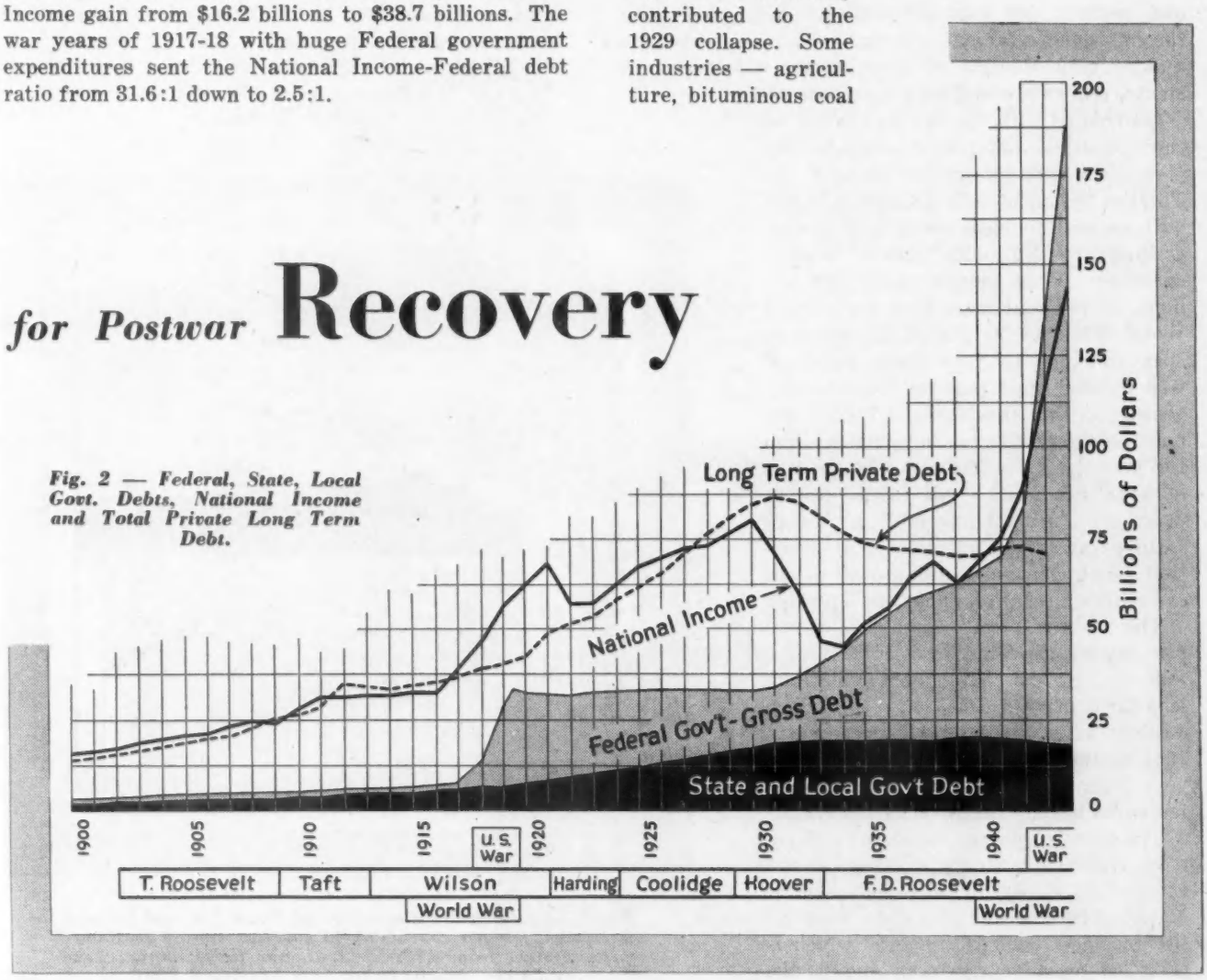


Fig. 2 — Federal, State, Local Govt. Debts, National Income and Total Private Long Term Debt.

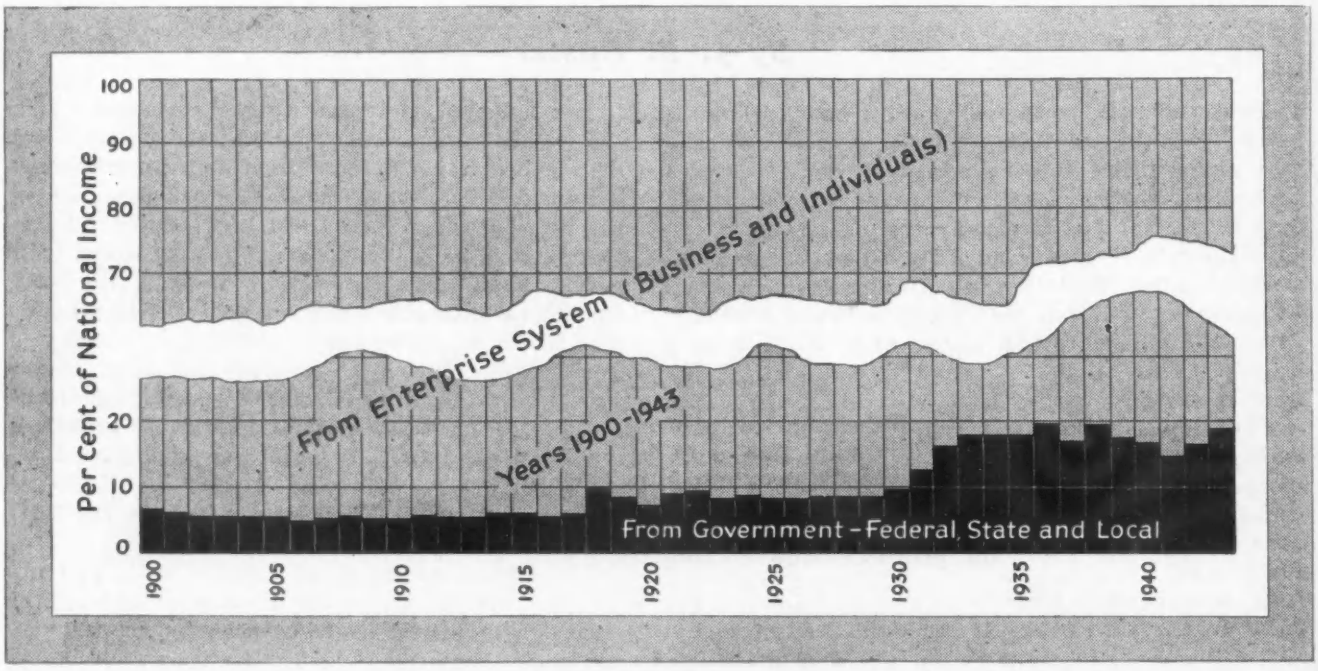


Fig. 3—Sources of National Income.

and textiles, for example—did not keep pace with the improving national economy. There was also the undermining element of speculation—widespread in stocks, real estate and building construction.

Contrasted with the recovery policy of the Twenties was the attempt by the New Deal administration during the Thirties to improve the national economy with an anti-business policy and by controlling the National Income through spending. Even though nearly $62 billions, 55 per cent more than the cost of World War I to the United United, were spent during the first eight years, it was for the most part an unproductive venture in that the National Income did not increase in faster proportion than the growth of the Federal debt, as may be seen in Fig. 1. This failure to improve the National Income-Federal debt ratio parallels the unemployment situation which continued unimproved at the same high level throughout the Thirties.

The adverse effect on business expansion during the Thirties is still further indicated by the change in the nation's long-term private debt (Fig. 2), which declined after 1930 and was exceeded in 1941 by the total governmental debt. A year later the total governmental debt increased beyond the National Income.

The growing encroachment of government into the business economy of the country is shown by a comparison of National Income and the share supplied by "income from government," which is compiled on a yearly basis and is the total income received by individuals from government as wages, salaries, pensions, interest, work relief, direct relief, rental payments, etc. Fig. 3 shows clearly

(*Turn to page* 102, *please*)

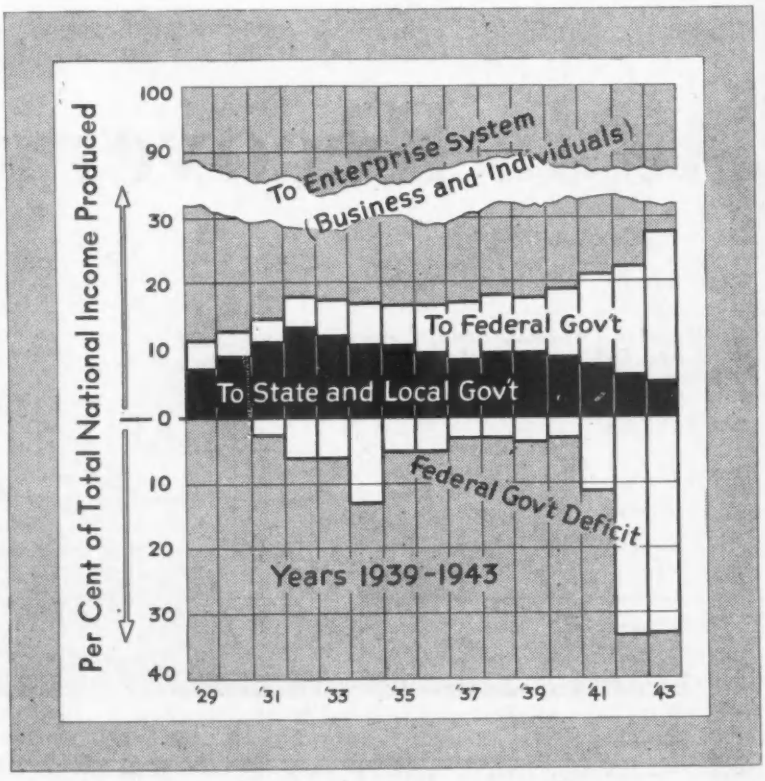


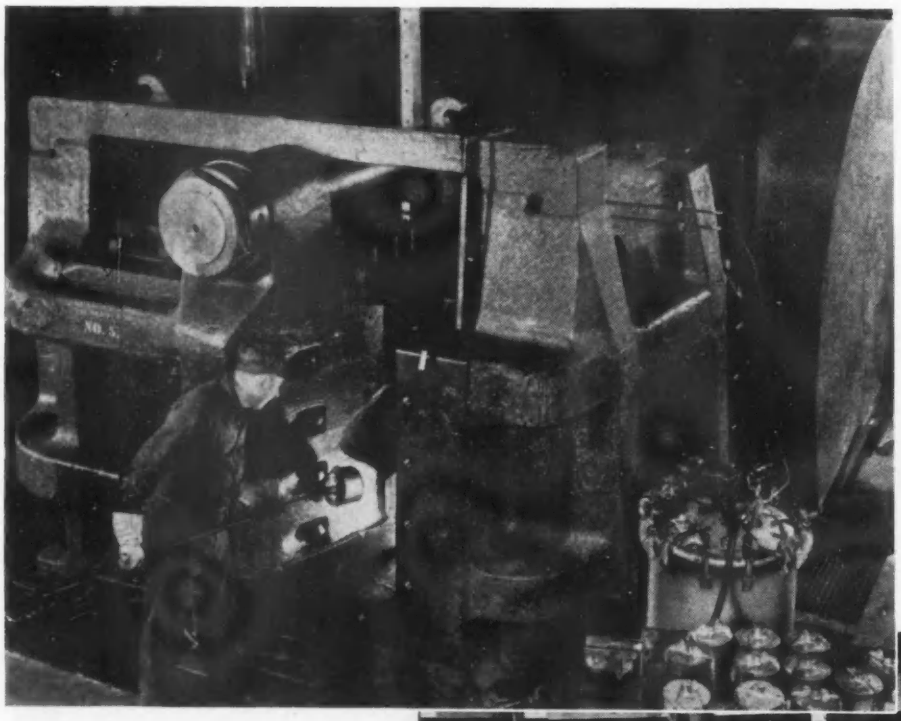
Fig. 4—Upper Half: disposition of Total National Income Produced, the per cent going to government and to Enterprise System from 1929-1943. Lower Half: annual Federal Govt. deficits in per cent of annual TNIP.

Little Detroit in New Guinea

This production center, Little Detroit, one of a series set up by the Ordnance Dept. at U. S. Army bases with assembly lines patterned after those in Detroit, is being operated somewhere in the New Guinea jungle. Time was taken out recently for a little celebration when the 5500th vehicle rolled off the line.

General view of the Little Detroit assembly line.

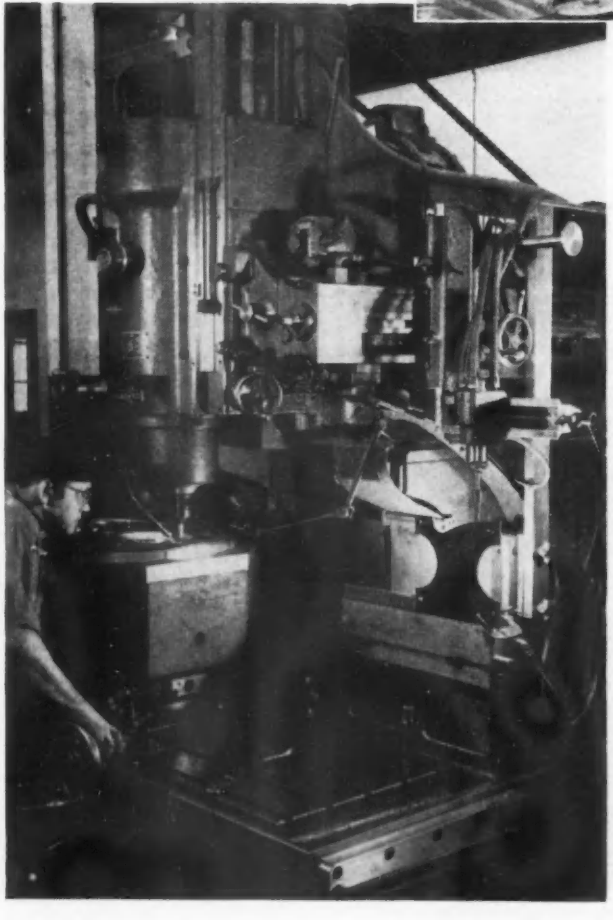
Front and rear axle assemblies—the beginning of a 2½ ton 6x6 Army truck.



(Left) Close-up of work station of one of the huge 8 in. Ajax upsetters, shown here on a run of aluminum aircraft engine pistons.

(Below) One of a group of burring and polishing benches, showing the excellent lighting facilities and the use of the Kellerflex portable polishing machines.

(Below) This Cincinnati Hydro-Tel is one of the items of advanced equipment found in the die shop.



Anderson

Fourth Unit

AN ALUMINUM forge plant opened in Anderson, Ind., constitutes the fourth unit of this kind in the nation-wide manufacturing system of the Chevrolet Motor Division of General Motors Corp. The new unit is operated under the general supervision of the Chevrolet manufacturing plant in Muncie, Ind., first of the division's units to get into volume production of aluminum forgings. Prior to the commissioning of the Anderson plant, we described in AUTOMOTIVE & AVIATION INDUSTRIES, July 15, 1943, the modern aluminum plant built by Chevrolet in Saginaw, Mich., for the production of propeller blades, crankcase sections, pistons, and a wide variety of other aircraft parts.

It is of interest to learn from a recent news release by M. E. Coyle, general manager, that during 1943 Chevrolet had delivered 76 million pounds of aluminum aircraft forgings, ranging from minute

Aluminum Forge Plant

of Chevrolet System

By Joseph Geschelin

engine parts to eight-foot propeller blades. This compares with an output of 8.2 million pounds produced by Chevrolet in 1942.

Formerly used as a wire mill, the Anderson property covers 21 acres. Out of use for a number of years, the buildings and site were acquired by the Defense Plant Corporation early in 1943 and turned over to Chevrolet for conversion and operation. So complete was the remodeling program that only shells of the original buildings were retained.

Four buildings make up the main production units, all of which have been modernized completely and partially rebuilt for manufacturing departments. Two of the plant units, each nearly 550 feet long, are used for processing and heat-treating. A third has been converted into the main aluminum forge plant, where the heavy presses and forging equipment are installed, while a fourth houses the materials-testing laboratory and tile-finished kitchen and cafeteria.

A distinguishing feature of the new unit is the adoption of some of the largest equipment of its kind, including 2000-ton H-P-M hydraulic presses, 4000-ton Clearing presses, 8-in. Ajax upsetters, and a large battery of Surface Combustion Co. gas-fired heating and heat-treating furnaces as well as a huge homogenizing furnace.

In contrast to the equipment in the Saginaw forge where heavy drop hammers are employed, the Anderson unit has adapted hydraulic and mechanical presses for its forging operations. Through skillful development of dies designed for forging presses and by making the most of the versatility of these hydraulic and mechanical presses, the Anderson management has found it possible to produce many large and intricate aluminum forgings in economical fashion.

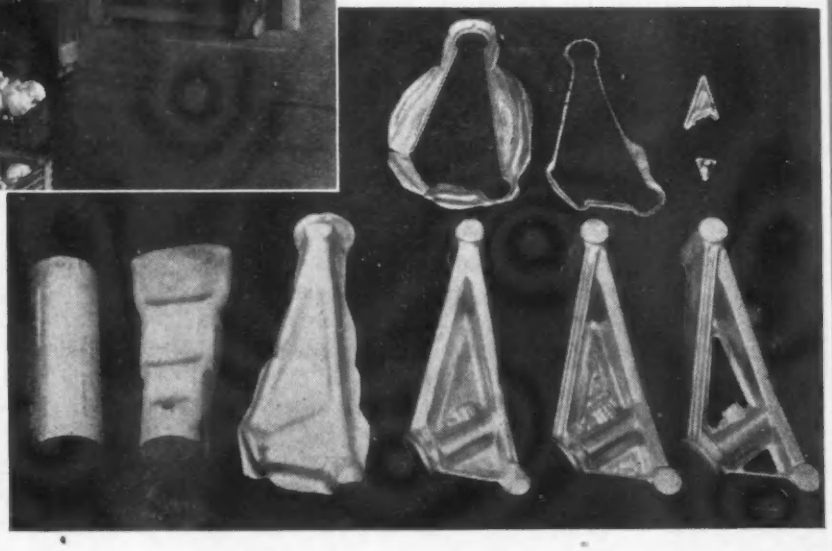
The first building of this unit houses facilities for preparing billets for the press operations. Material is received in the form of rounds in various diameters, in "as cast" condition. For example, 11 in. diameter billets are used for cylinder head forgings. They are heat treated in a huge Surface-Combustion homogenizing furnace for 18 hours at 950 F. The furnace is gas-fired and of pusher type. In preparation for cutting into short blanks, the billets are scalped—lathe-turned with an extremely heavy cut—on Lodge & Shipley No. 3A Duomatic lathes, of which there are two at the present writing.

In one section of the building the forging department has two hydraulic presses rated 2000-ton capacity. Another large section houses a battery of four mechanical presses rated 4000-ton capacity. These, in turn, are served by four presses for trimming. Each of the forging presses is served by a conveniently-located Surface-Combustion heating furnace of the continuous convection-heated type, having a capacity of 8000 pounds. Temperature control of furnaces is most important since each operation requires a specific range in temperature. For example, blocking operations require a temperature between 820 and 840 F, while finishing requires a temperature between 840 and 860 F.

A difficult forging such as an aircraft engine cylinder head would be processed over practically every piece of equipment in the plant. Following homogenizing, the billets are scalped and sawed to length.

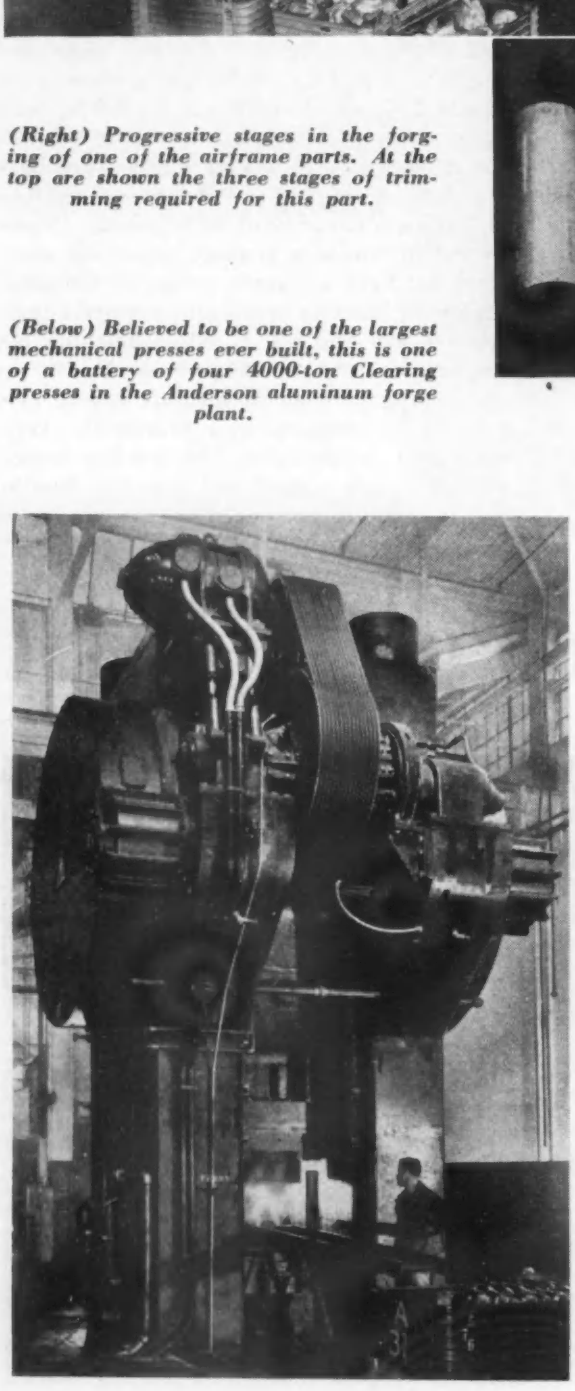
Close-up of trimming operation in a Bliss press, showing the die and punch and providing a good view of the size and formation of the forging.

(Left) Another view in the forge department, showing the battery of S-C heating furnaces which serve each of the clearing presses. Note the BullDog trolley duct system for the materials handling hoists.



(Right) Progressive stages in the forging of one of the airframe parts. At the top are shown the three stages of trimming required for this part.

(Below) Believed to be one of the largest mechanical presses ever built, this is one of a battery of four 4000-ton Clearing presses in the Anderson aluminum forge plant.

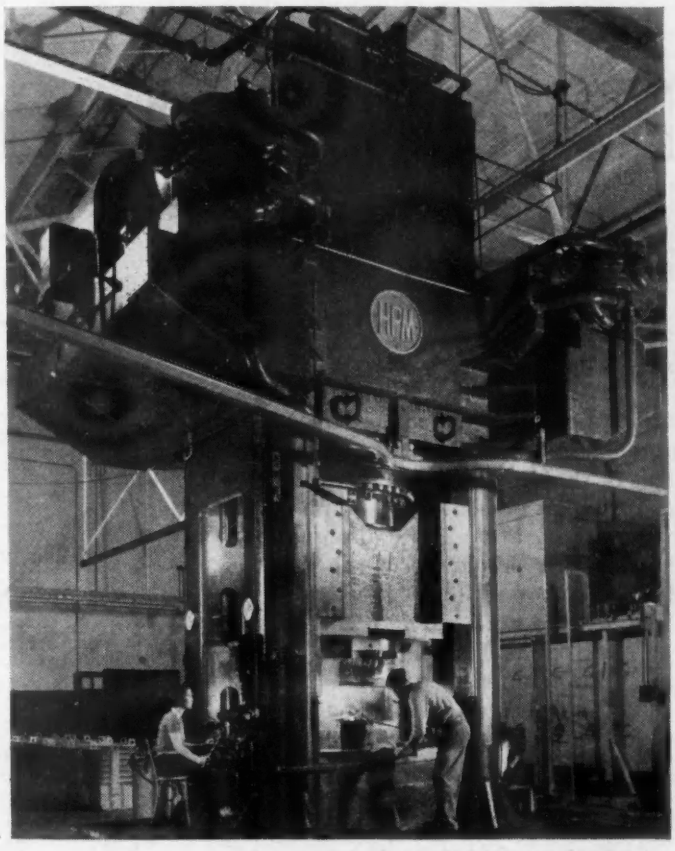


These slugs are rough-shaped in the HPM hydraulic presses, blocked and finished in the Clearing mechanical presses, and upset (to form the inside of the head) in the Ajax upsetters. The battery of two, 8-in. Ajax upsetters is also employed for the production of cylinder cooling fins, pistons, etc.

In another building of the group is housed the heat treating department. This is connected with the forge building by a long monorail conveyor which transports forgings to the furnaces. Here are found four identical batteries of Surface-Combustion solution treatment furnaces of roller hearth, recirculating type. The heat treating cycle consists of three stages—heating to 950 F in the S-C furnace, quenching at the exit end of the furnace, then aging at 350 F and stress relieving at 450 F in Ross System ovens. The three stages are arranged for straight-through continuous-flow of work on each of the four lines.

The same department boasts two specially-designed automatic conveyor-type etching and anodizing systems. The dip tanks are arranged in the form of an oval, served by an overhead conveyor system which is alternately lifted and lowered by means of a heavy-duty centrally-mounted air cylinder.

Facilities for die repair and rebuilding, as well as for emergency die production, are housed in another section of the plant. It is well equipped for its functions and among other things contains a Cincinnati Hydrol-Tel, a Cincinnati plain grinder, two small P & W Keller die-duplicating machines, and other essential equipment.



Here is one of two 3000-ton H-P-M Fastraverse hydraulic forging presses in the Anderson unit. Operation of the press cycle is handled by a woman operator as shown at the left. To the right may be seen one of the S-C heating furnaces.

The plant is well lighted throughout, power distribution for lighting being handled by a Trumbull Electric duct system. This system also provides power for the portable tools used on the burring and polishing benches. Heating furnaces are served by small hoists which get power from a Bull-Dog trolley rail system.

A group of burring and polishing benches is found in the forge shop as well as in the heat treating department where the final finishing touches are applied. These benches are served by the familiar Kellerflex portable tools.

The gamut of materials—handling tasks within departments and for inter-departmental hauling—are handled by a fleet of industrial trucks of various types.

Some impression of the range of work that can be processed in this plant may be gained from an examination of the kinds of pieces that have been produced in the beginnings of this operation. The largest piece made thus far is a crankcase section weighing 155 pounds in the rough. The biscuit is prepared on an H-P-M hydraulic press, then blocked on a Clearing press. A tail wheel support bracket being produced in large quantities weighs 75 pounds, rough, and trims to 58 pounds. Among other parts produced here are a nose wheel bracket, thrust bearing retainer, and cylinder muffs and pistons which are made on the upsetters. In addition, small runs have been made on impeller forgings for superchargers.

Close and accurate control of ram stroke of the hydraulic presses lends them to the production of long forgings such as airframe spars. This operation can be facilitated by the use of a manipulator which is available for the purpose.

As mentioned earlier, die design must be skillfully patterned to the special requirements of forging presses, *i. e.*, certain modifications in conventional practice are essential. Among other things, they have found it expedient to introduce vents in certain parts of dies to facilitate filling of dies at deep or intricate sections. Thus far, best results have been achieved with the use of graphite mixed with an oil vehicle.

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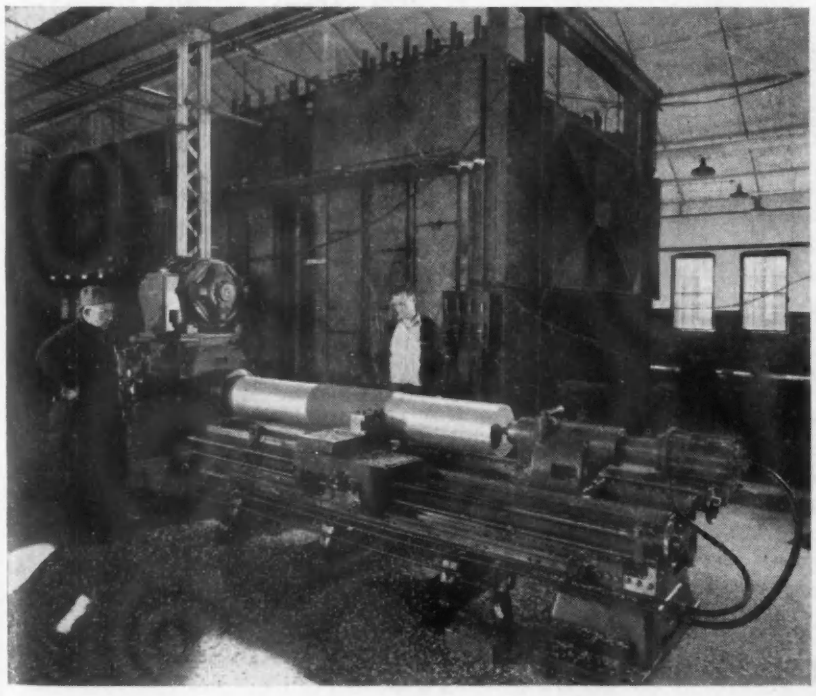


First stages of preparation for forging. In the background is the huge S-C homogenizing furnace for heat treating "as cast" billets. In the foreground is one of the two Lodge & Shipley Duomatic lathes engaged in "scalping" one of the big billets.

Notes on Magnesium Alloy

ALTHOUGH a considerable quantity of data on the mechanical properties of magnesium alloys is available, information on this subject is by no means complete. These notes represent some of the experience gained by Northrop Aircraft through designing with magnesium. For general design work, the following properties of the material should be known:

1. Tensile yield strength corresponding to the 0.002 in. per in. offset
2. Ultimate tensile strength
3. Compressive yield strength corresponding to the 0.002 in. per in. offset
4. Ultimate compressive strength*
5. Ultimate shear strength
6. Bearing yield strength corresponding to 0.005 in. per in. permanent set
7. Ultimate bearing strength*
8. Modulus of elasticity in tension, E_t
9. Modulus of elasticity in compression, E_c
10. Modulus of elasticity in shear, G**
11. Poisson's ratio, μ***

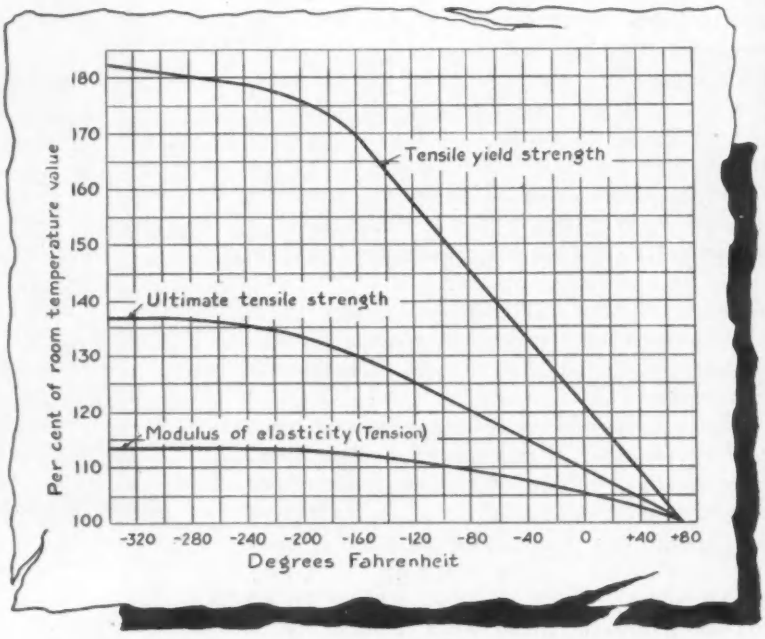


Fig. 2—Curves showing improvement in mechanical properties of J-1 magnesium alloy at subnormal temperatures

Mechanical Properties

The vendor of magnesium alloys processes his stock to ensure conformance with a set of minimum specifications. Table I contains the set of minimum specifications adhered to by the Magnesium Products Co., a Dow Chemical Co. licensee. In general, the products received from the vendor far exceed these minimum specifications. However certain batches *may* exhibit the minimum allowable properties so that it is

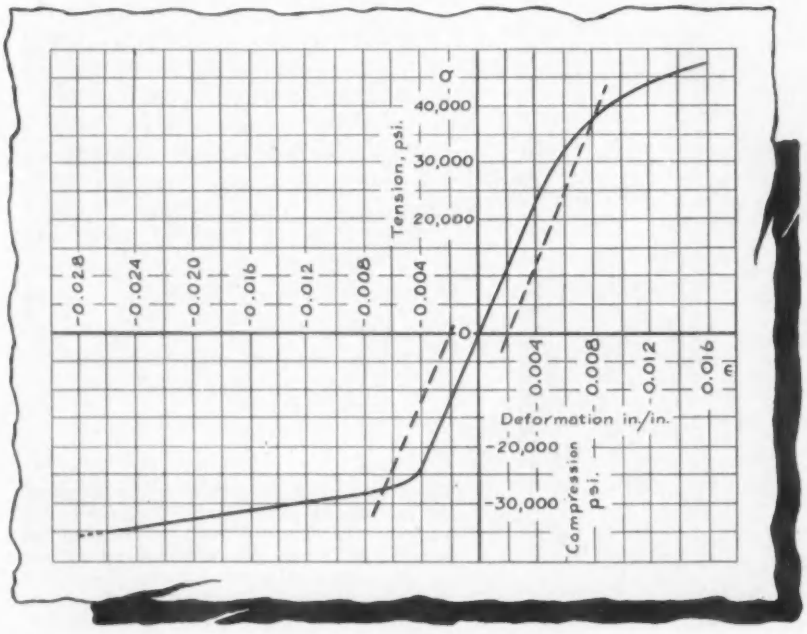


Fig. 1 — Typical Stress-strain Curves for J-1 Magnesium Alloy

* When designing for the Army, assume that ultimate compressive strength is one and one-half times the compressive yield strength noted above. Assume also that this same ratio exists between the ultimate bearing strength and the bearing yield strength given above.

** It may be assumed that the modulus of elasticity in shear, is $G=(E_t-E_c)/4(1-\mu)$.

*** Several tests carried out in the Northrop Aircraft laboratories indicate that a value of 0.32 may be used for Poisson's ratio in design. This value was determined by measuring the increase in circumference of a specimen loaded in compression.

in Design

By R. O. Brittan
Project Stress Engineer,
Northrop Aircraft, Inc.

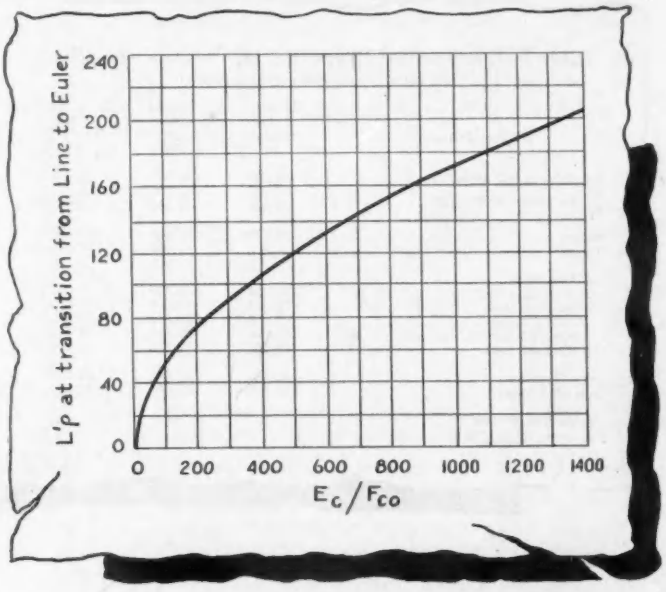


Fig. 4—Values of L'/ρ at which the Euler curve and the straight line coincide

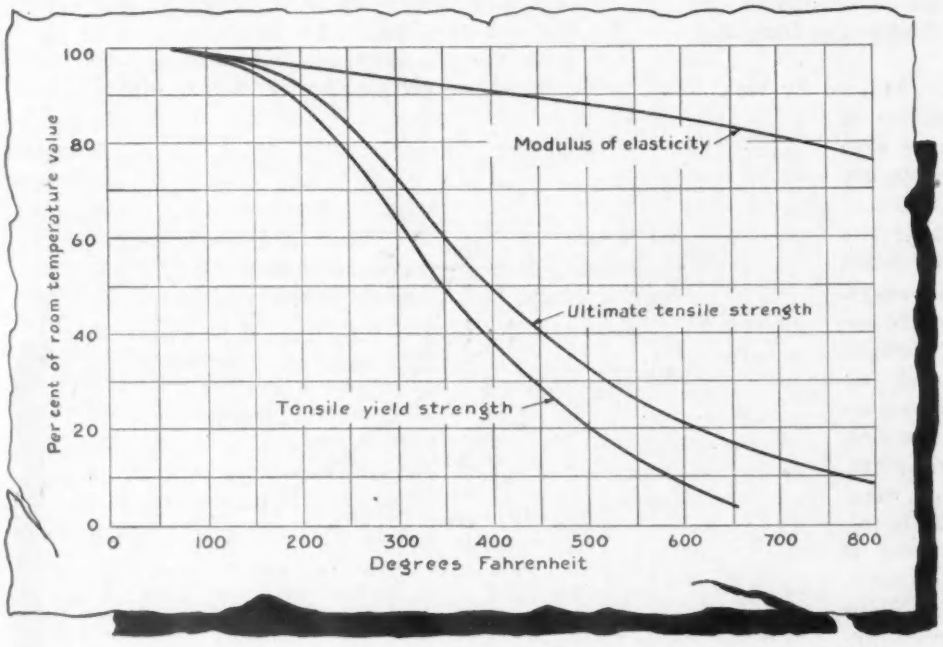


Fig. 3—Curves showing impairment of mechanical properties of J-1 magnesium alloys at high temperatures

necessary to use the minimum specified values in design. The manufacturer may choose to incorporate a quality control system coupled with stock segregation. If such control is effective, *minimum test values* should be used in design. Only in the case of the moduli of elasticity in tension and compression should *average* test values be used.

Typical tension and compression stress-strain curves are shown in Fig. 1. Values from these curves should not be used in design since they are merely included here to indicate qualitative characteristics. Variance between the two branches of the curves is marked. Note especially the extremely sharp break in the compression curve at the yield point. This general characteristic of a sharply defined compression yield point, having a value far below that in tension, becomes a detrimental design criterion and steps are being taken at present to eliminate this undesirable characteristic. Loading above the yield point in compression will drop the tension yield point considerably and raise the compression yield point to the value last reached, and *vice versa*. This characteristic must be borne in mind when forming operations are contemplated.

The bearing yield point is assumed to have been reached when a permanent set of 0.5 per cent of the hole diameter is attained. The ultimate bearing strength is assumed to be equal to 150 per cent of the bearing yield stress. Twenty-five tests run by Northrop on the J-1 alloy gave a maximum bearing yield stress of 33,000 psi, an average of 29,210 psi, and a minimum of 26,700 psi. Similarly, twenty tests run on the J-1H alloy gave a maximum bearing yield stress of 47,000 psi, an average of 39,480 psi, and a minimum of 32,500 psi. From these figures the ultimate bearing strengths are obtained by multiplying by 1.5.

The only mechanical properties of the J-1 alloy for which high- and low-temperature values are available are the ultimate tensile strength, the tensile yield strength, and the modulus of elasticity in tension. Curves of these properties plotted against temperature are shown in Figs. 2 and 3. The curves are based on data for an equivalent alloy (AZM) given in "The Technology of Magnesium and its Alloys" by A. Beck, translated from the German and published by F. A.

Table I—Mechanical Properties of Magnesium Alloys

(Dow Minimum Plant Specifications)

J-1 Alloy Extrusions:	Ultimate Tensile Strength Psi	Tensile Yield Strength Psi	Compressive Yield Strength Psi
Bar Stock up to 7 sq. in.	40,000	26,000	16,500
Bar Stock 7 to 25 sq. in. A*	38,000	22,000	14,000
Bar Stock 7 to 25 sq. in. B*	24,000	10,000	10,000
Shapes	38,000	23,000	16,000
Tubing	36,000	17,000	11,000
J-1 Alloy Plate			
0.251-0.500 thick	40,000	30,000	19,000
0.501-0.750 thick	40,000	28,000	18,000
0.751-1.000 thick	40,000	25,000	16,000
1.001-1.500 thick	38,000	23,000	15,000
1.501-2.000 thick	35,000	21,000	14,000
J-1h Alloy Sheet	42,000	32,000	20,000
J-1a Alloy Sheet	40,000	22,000	14,000

*A, along center line
*B, across center line

Hughes & Co., Ltd. (London, 1941). The low-temperature values are in good agreement with results obtained by the National Bureau of Standards and published in the journal of the Bureau for December, 1940, pp. 673-701.

If stress-strain diagrams are obtained by test, it will be discovered that the modulus of elasticity is apparently at variance with the generally accepted value of 6,500,000 psi. This accepted value only occurs in the low stress range up to one or two thousand psi. and is difficult to detect by test. Above this low stress range, in the working range and up to the apparent proportional limit, the modulus of the stress-strain curve generally attains a lower value. For the various states of the alloy such as hard-rolled, hot-rolled, annealed, or pre-stretched, the modulus will assume a value ranging from 5,700,000 psi. to 6,500,000 psi. In dealing with stability problems or statistically indeterminate structures, this variation in modulus should be taken into account if an accurate analysis is desired.

It is suggested that the straight-line column formula be used in the short column range until enough design information has been accumulated to enable the establishment of a series of curves similar to those used for design work in aluminum and steel tubing. According to this formula, the allowable column stress is

$$F_c = F_{co}\left[1 - \frac{0.385\ (L'/\rho)}{\pi\sqrt{E_c/F_{co}}}\right],$$

where L' is the modified length $L/\sqrt{c}$, c being the restraint coefficient;

ρ, the least radius of gyration of the section of the column;

E_c, the modulus of elasticity in compression, and

F_{co}, the column yield stress.

The value of F_{co} is taken equal to F_{cyp}, the stress at the yield point, in conformance with the sharply defined yield point previously noted.

Throughout the long column range, Euler's expression for the buckling stress should be used, viz.,

$$F_c = (\pi^2 E_c)/(L'/\rho)^2 = (\pi\sqrt{E_c}/L'/\rho)^2$$

To aid in establishing design curves, it is often advantageous to utilize a non-dimensional column formula. Development of such a formula for use with magnesium is as follows:

In the short and long column formulae given above, let

$$(L'/\rho)/(\pi\sqrt{E_c/F_{co}}) = B \quad \text{and} \quad F_c/F_{co} = R_a.$$

The short column curve then becomes:

$$R_{as} = 1 - 0.385B,$$

while the long column or Euler curve will be:

$$R_{ae} = 1/B^2 = B^{-2}$$

At the point of transition from the range where the straight-line formula applies to that where the Euler formula is applicable, the slope (dR_a/dB) is the same for both curves. Then if the slopes

$$dR_{as}/dB = -2B^{-3} \quad \text{and} \quad dR_{as}/dB = -0.385$$

are equated, we get for the transition point:

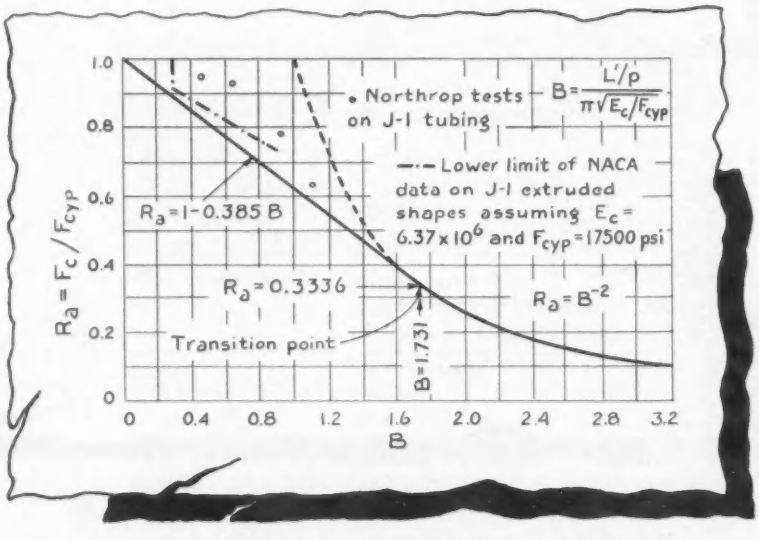


Fig. 5—Non-dimensional column curve incorporating the straight line formula and Euler's expression

$$B = \sqrt{2/0.385} = 1.731 = (L'/\rho)/(\pi\sqrt{E_c/F_{co}})$$

and $R_a = 1 - 0.385B = 0.666$

Thus it is seen that the transition-point value for L'/ρ is always:

$$1.731\pi\sqrt{E_c/F_{co}} = 5.44\sqrt{E_c/F_{co}}$$

Values of the transition point are plotted in Fig. 4 for the range of $0 < E_c/D_{co} < 1400$. The non-dimensional column curve is given in Fig. 5.

If, as previously suggested, quality control is exercised by the fabricator so that the modulus of elasticity and yield stress in compression are known for

Table II–Minimum Values of Compressive Yield Stress for Magnesium Alloys of Dow Chemical Co.

Alloy	Form	Compressive Yield Strength, psi
M	Shapes	9,000
	Bar Stock up to 7 sq. in.	8,000
	Bar Stock from 7 to 25 sq. in.	7,000
	Tubing	7,000
J-1	Shapes	16,000
	Bar Stock up to 7 sq. in.	16,500
	Bar Stock from 7 to 25 sq. in.	14,000
	Tubing	11,000
FS-1	Shapes	15,000
	Bar Stock up to 7 sq. in.	13,000
	Tubing	11,000

		Plain	Aged	Experimental Heat Treat	Experimental Heat Treat and Aged
0-1	Shapes	18,000	22,000	16,000	30,000
	Bar up to 7 sq. in.	20,000	24,000	19,000	30,000

each piece of stock, these known values may be used in conjunction with the non-dimensional column formula for design. It is only necessary to evaluate B to obtain F_c when (L'/ρ), E_c, and F_{cyp} are given.

If no test values are available for F_{cyp} and E_c, minimum specified values must be used. Table II provides minimum values of the compressive yield strength for various products of the Dow Chemical Co. A set of curves for the J-1 alloy, based on the column formula given above, is shown in Fig. 6. Values for these curves were calculated using a value of $E_c = 5{,}700{,}000$ psi which corresponds to minimum values obtained for the working range of stressses in a series of compression tests run on J-1 stock tubing. The curve in the long column range is the same for the various forms of stock because E_c is the same. Hence

$$F_{ce} = (56300 \times 10^3)/(L'/\rho)^2$$
$$[(L'/\rho > (L'/\rho)_{trans.}]$$

The straight line portions extend from the values of F_{cyp} given in Table II to the transition points which may be obtained from Fig. 4 for values of F_{cyp}/E_c. Slopes of these curves are obtained if needed from the expression

$$\text{slope} = \beta = 5.13 \times 10^{-5} (F_{cyp})^{1.5}$$

emanating from the straight line formula in the form

$$F_{ce} = F_{co} - \beta(L'/\rho)$$
$$[0 < (L'/\rho) < (L'/\rho)_{trans.}]$$

For these curves, it should be remembered that the lowest test values for E_c were used. Such a practice obviously leads to a very severely conservative design and can be offset only by obtaining stock which exhibits a more favorable modulus when tested.

The notes given for column design are valid only for columns having stable cross-sections. Local buckling or crippling failures and torsional instability failures may not be handled by the above methods. Very little test data on the latter type of failures are available.

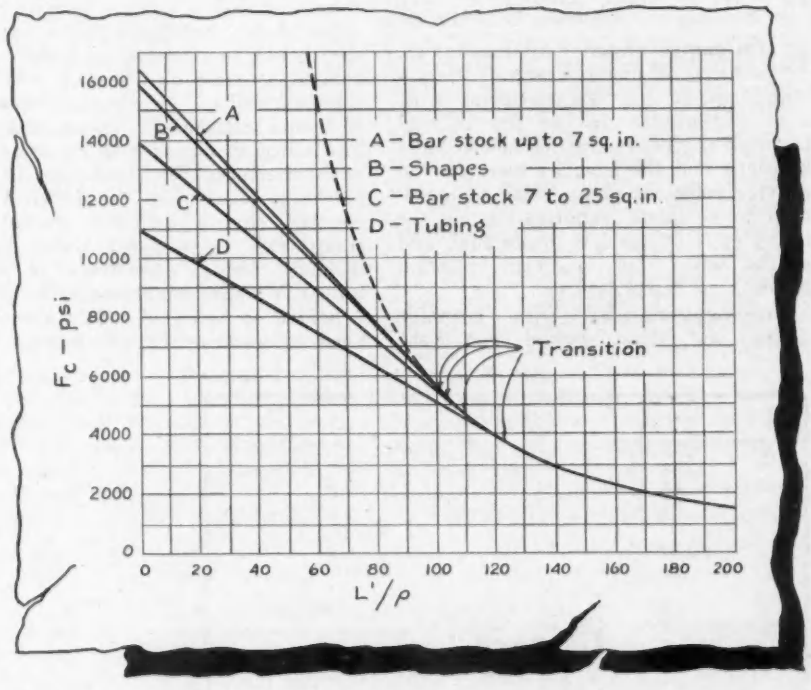


Fig. 6—Column curves for J-1 magnesium alloy extruded stock (Based on F_{cyp} given in minimum plant specifications and a value of $E_c = 5{,}700{,}000$ psi. Curves to be used with stable cross-sections only).

New Service for Locating Screw Machine Capacity

Due to the many requests for assistance in locating available machine capacity, the National Screw Machine Products Association has set up a clearing house for taking care of such requests.

All member companies are now reporting to the Association machine capacity presently available and capacity expected to be available in the near future. Additional information furnished by these companies enables the Association to promptly locate the manufacturers best equipped to produce a particular part.

This service is provided free to buyers of screw machine products. Names of suppliers having suitable available capacity may be obtained by furnishing the Association with a description of the required part, including type of material, tolerances, and quantity required.

Inquiries should be addressed to Dept. K, National Screw Machine Products Association, 13210 Shaker Square, Cleveland 20, Ohio.

Technical Papers at SAE Chicago Meeting Reveal Wartime

Progress i

AT THE National Diesel-Fuels and Lubricants Meeting sponsored by the Society of Automotive Engineers in May at Chicago, engineers from industrial plants, U. S. Army and Navy joined in a discussion of important engineering problems and developments in that field. Nine papers were presented at the four technical sessions during the two days, abstracts of which are published here with the exception of two papers—"Adequate Piston Cooling" by Gregory Flynn, Jr., and Arthur F. Underwood, of the Research Laboratories Div., General Motors Corp.; and "Diesel Engine Operating Experiences on the Alcan Highway," by Lt.-Col. E. F. Norelius, Office of Chief of Ordnance, and Capt. J. L. Cassell, Office of Chief of Engineers. The General Motors engineers reported on tests of cooling pistons with jets of oil and stated this development is practicable from an engineering standpoint and offers a possible means of preventing higher piston temperatures as engine outputs increase. Abstracts of available papers follow:

The Effect of Piston Design on Piston Ring Sticking

By Harry F. Bryan, Research Engineer, International Harvester Co., Inc.

EACH engine designer approaches the subject of piston design from the standpoint of his own particular problems and needs. In our line of carburetted engines operating on distillate, kerosene and the like, we have had to provide sufficient piston head temperature to complete vaporization of the heavy ends of the low grade fuel, and at the same time, maintain optimum piston ring temperatures.

Investigations of heat transfer around the piston showed that there is a constant change of conditions throughout the engine cycle. However, under constant load and speed, the changes follow a definite pattern, cycle after cycle; consequently, a step-by-step bench test procedure could be arranged to yield satisfactory and conclusive results. A schematic drawing of such a test stand is shown in Fig. 1. The piston complete with its rings, and with thermocouples installed at the points to be checked, is mounted in a regular engine cylinder sleeve and surrounded by a short water jacket through which circulation is maintained at a measured rate. The piston is heated on the head-end by the direct blast of an inverted gas burner. An electric heater and a cooling coil are installed in the lower tank to maintain the required circulating water temperature.

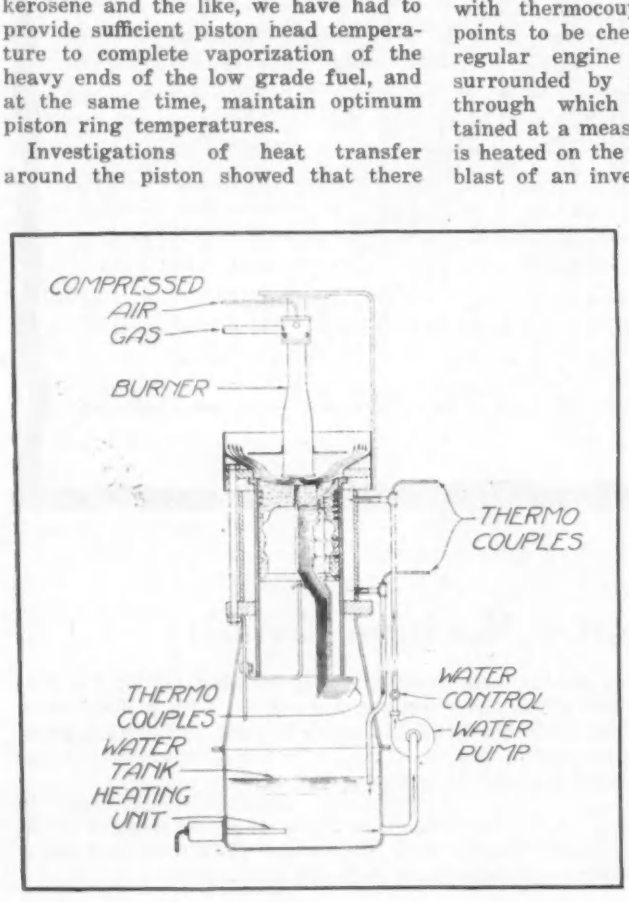


Fig. 1 — Piston temperature test setup.

In correlating the bench test to actual engine conditions, certain observations of engine operation must be noted. The least obvious of these is the method of obtaining the maximum piston temperature, namely, by installing fusible plugs in the piston head. Later, in the bench test, these fusible plugs are replaced by thermocouples.

In a typical series of tests, two iron pistons of different design and a production aluminum piston were compared. All three had the same head surface area and the same outside surface area of the barrel portion of the piston. The piston were run in 4- and 6-cyl Diesel engine (4¾ in. bore by 6½ in. stroke) operating at 1200 to 1400 rpm. The compression ratio is 13.67 to 1 and the maximum combustion pressure range is from 725 to 780 psi.

Piston A (cast iron) performed satisfactorily except that considerable carbon formed under the head after 100-150 hours. After the metal thickness of the head was increased, this piston was accepted for production. Piston B (cast iron) proved unsatisfactory as, after a 600 hour, full load test, the top rings were stuck and excessive carbon formed under the head. Fig. 2 presents an interesting and detailed graphical study of heat conditions in all three pistons tested.

Practical conclusions can be derived from such tests as the above: Definite control of the heat flow to the rings is necessary in Diesel engine iron pistons and can best be obtained by limiting the area of the cross-section immediately above the top ring, or back of all the rings; the piston rings are only 65

in Diesel Field

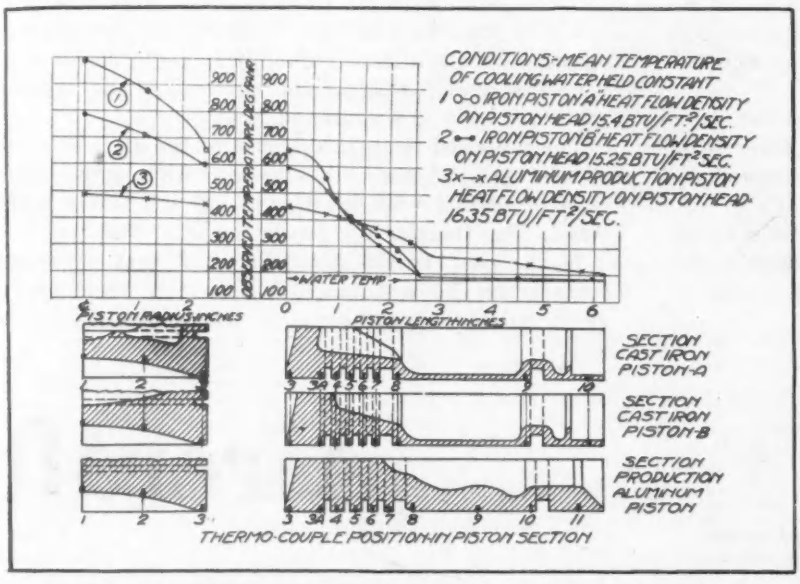

CONDITIONS-MEAN TEMPERATURE OF COOLING WATER HELD CONSTANT
1 o-o IRON PISTON 'A' HEAT FLOW DENSITY ON PISTON HEAD 15.4 BTU/FT²/SEC.
2 •-• IRON PISTON 'B' HEAT FLOW DENSITY ON PISTON HEAD 15.25 BTU/FT²SEC.
3 x-x ALUMINUM PRODUCTION PISTON HEAT FLOW DENSITY ON PISTON HEAD 16.35 BTU/FT²/SEC.
WATER TEMP
PISTON RADIUS-INCHES
PISTON LENGTH-INCHES
SECTION CAST IRON PISTON-A
SECTION CAST IRON PISTON-B
SECTION PRODUCTION ALUMINUM PISTON
THERMO-COUPLE POSITION-IN PISTON SECTION

Fig. 2—Effect of material and design on piston surface temperature I.H.C. piston test bench

per cent as effective as the ring lands and skirt of the piston for transferring heat from the piston to the cylinder wall—the larger the ring clearance, the less effective the rings become; the thermal break between the piston surface and cylinder wall has the lowest coefficient of heat transfer of any point in the path of heat flow from the piston head surface to the cooling water, and constitutes the major restriction to heat flow through the piston; and, the proper use of ribs in the piston head improves the conductivity of the piston and promotes uniform heat distribution in the cast iron piston with a minimum amount of material.

Filtration of Diesel Fuel and Lubricating Oils

By Lt. H. V. Nutt
U. S. Naval Engineering Experiment Station

THE functions of a lubricating oil or fuel oil filter seldom have been clearly defined. This has been due, in part, to varying claims of filter manufacturers, the inability of the industry to agree on how clean an oil must be to be satisfactory and the difficulty in obtaining reliable test data. The first step taken by the U. S. Navy to place the function of filtration on a sound and workable basis was to standardize the size and shape of filter units. Two sizes of fuel filters and two sizes of lubricating oil filters were adopted, after exhaustive tests, with the larger of the two filters being approximately twice the size of the smaller. The Navy Standard Small lubricating oil filter element is identical in size to the U. S. Army Military Standard "Senior" element. All makes of elements in any one size classification are required to be interchangeable.

The next step was to evaluate the required performance of filter elements in service. It was found that long life and high, solids-removal rate were of the greatest importance. In testing lubricating oil filters, two tests were devised; one, a batch test in which the filter was required to clean an oil contaminated with lampblack; and the other, a practical test on a 100 horsepower Diesel engine under actual operating conditions. Typical results from the latter type of test are shown in Figure 3.

The effect of oil additives, such as detergents, on filtration performance, and the tendency of filters to remove additives were subjects of later study. Typical results are shown in Figure 4. Note that straight mineral oil tests were run at the same time for comparison purposes. Separate tests on clean, additive-type oil were run to determine the effect of filters on additive content. Although it was found that many filters will remove much of the additive material, the evidence was inconclusive. The many variables present involving the type of additive, the type of filter and the contamination make it practically impossible to make a blanket prediction in this connection.

As a result of the many tests and the experience gained from each type of test, a single test was finally selected to replace both the batch test and the engine test. This latest test involves the recirculation of detergent oil contaminated hourly with a fixed amount

(*Turn to page 60, please*)

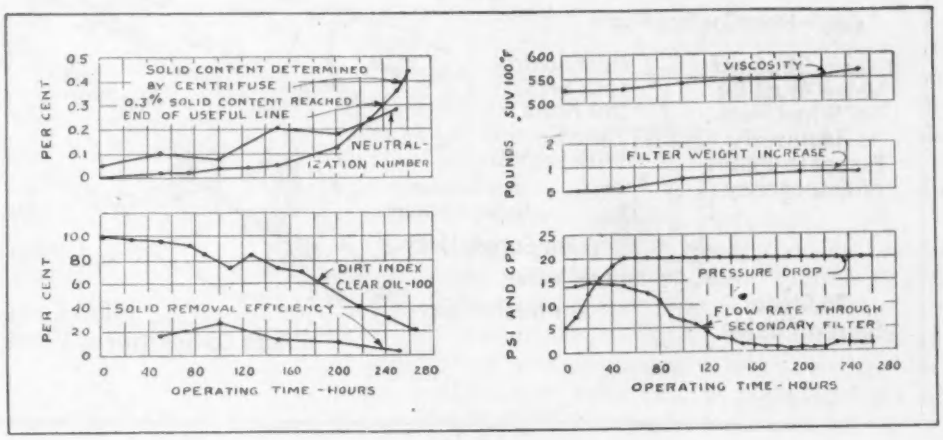


Fig. 3—Engine test of navy standard lubricating oil filter, 100 horsepower engine, straight mineral oil.

By Wilbur W. Reaser
Air Conditioning Engineer, Santa Monica Div.,
Douglas Aircraft Co., Inc.

Aircraft

EXTENSIVE use of airplanes in the bitter cold of the Far North and in the upper reaches of the troposphere has made the heating system of prime importance. Wartime flying, moreover, has proved that airplanes are not effective unless they have an adequate heating system, as they must be able to operate in all parts of the world the year round.

Before the various parts of an airplane heating system can be designed, the following six properties of the plane must be ascertained:

1. The type of airplane, whether it is a bomber, pursuit, transport or other type. These types differ with respect to insulation, and their heat requirements therefore vary likewise.

2. The speed for best climb. This speed is selected because it gives the minimum pressure supplied by the forward speed of the plane. Duct sizes are based on this speed.

3. The maximum speed. Additional heat will be *required* for *heating* ventilating air, since the air volume will increase almost directly as the airplane speed.

4. The maximum diving speed. High enough pressures may be created in high-speed diving to cause failure in the duct systems. This pressure may be as large as four times the cruising-speed pressure.

5. The maximum altitude at which the airplane will operate without a large reduction in performance.

6. The horsepowers of the engines, if the exhaust gases are used as a source of heat.

The proposed temperature rise of the air also must be selected in advance. It is made as high as the materials in contact with the heated air will safely withstand. The Douglas Co. allows a rise of 300 F.

In the past, specifications required that a certain temperature be maintained within the plane for a given outside temperature. It was found that even

Figure One

Schematic diagram of an airplane steam heating system.

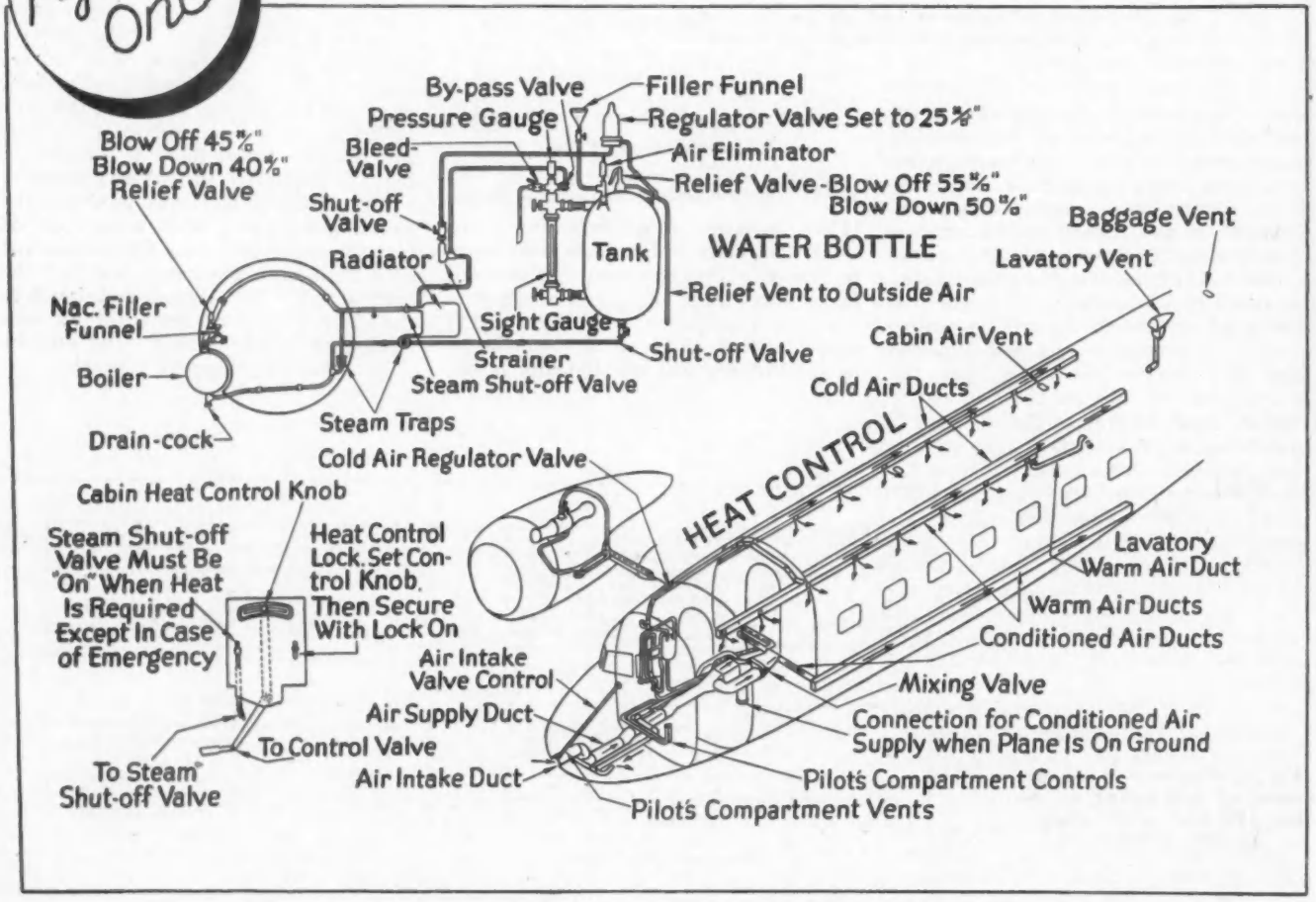
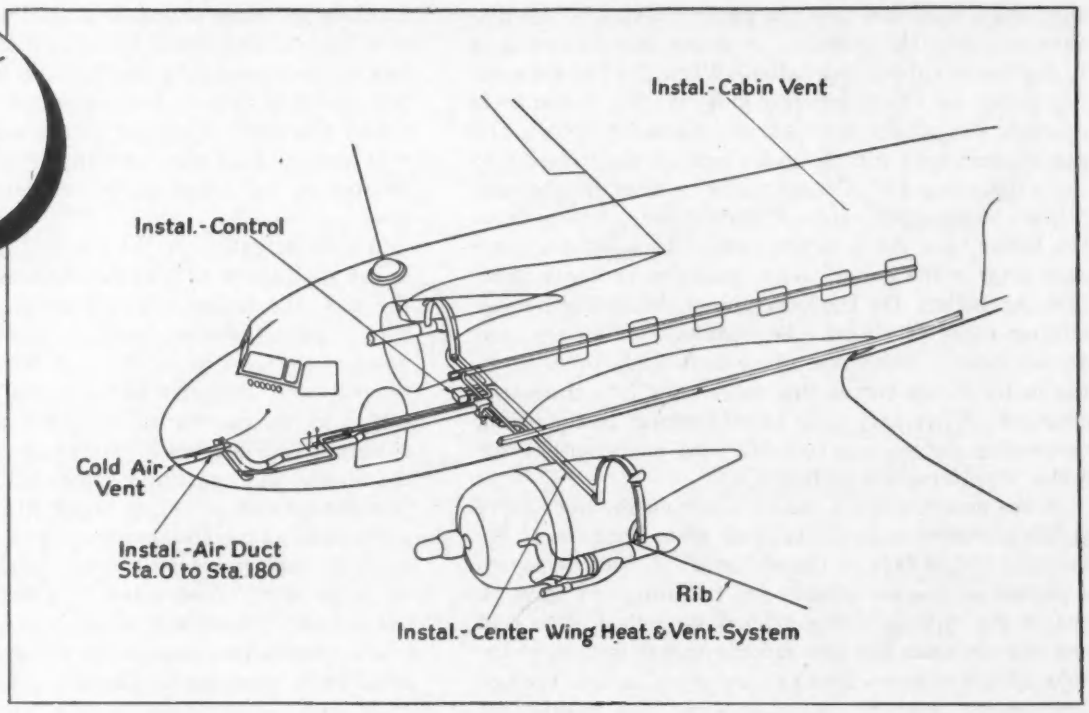


Figure Two



Production illustration of an exhaust hot air heater system.

Heating *Systems of* Three Types

though the specified temperatures were maintained, the occupants still would be uncomfortable in cold weather. This phenomenon, which is the result of heat loss by radiation from the occupant's body to the cold walls of the plane, has often been overlooked.

When calculating the skin temperature of an average man under flight conditions, the body is treated as a cylinder 5 ft 8 in. long and 13 in. in diameter. During flights it was noted that a ceiling distribution system gave the occupant a much greater feeling of warmth than did a floor-distribution system, although the outside temperature was 20 F and the cabin temperature 80 F in each case. The floor system produced a flow of air only over the occupant's feet. In contrast thereto, the ceiling system forced warm air around the entire body, at a velocity of 8 fps. When this system was used, the skin temperature was raised from 94.3 F to 96.3 F.

In addition to heating cabins, heat is being used to prevent ice from forming on and to remove ice already formed on windshield surfaces, leading edges of wings, and empennage surfaces. This makes it possible to fly in all kinds of weather, whereas in the past, airplanes had to be grounded when severe icing conditions existed.

The three heating systems used today on airplanes manufactured by the Douglas Aircraft Co. are the steam, exhaust hot air, and combustion types.

Steam System

The steam system consists essentially of a boiler and a radiator or condenser over which the cabin ventilating air passes to be heated. The boiler is supported in the exhaust pipe by lugs. Two corrugated cylinders are assembled so that there is a circumferential gap between the corrugation crests of the cylinders. A steam dome on top of the boiler collects the steam generated as the water passes through the gaps from a water sump on the bottom. The steam is piped to the upper part of the radiator where it is condensed, giving up its heat of vaporization to the ventilating air. The condensate is piped from the bottom of the radiator to the boiler. The rest of the system consists of a water tank, safety valve, pressure regulator, steam strainer, and piping. The water tank acts as a surge chamber. The pressure of the system is controlled by regulating the pressure of the steam entering the top of the water tank.

A set of mixing valves on the air-discharge end of the radiator controls the quantity of heat produced. One of the valves is connected to the radiator, the other to a duct which conveys cold air around the radiator. A shaft controlled from a quadrant in the cabin operates the valves in such a manner that when one is closed, the other automatically opens.

The operating principle of the system can best be understood by following the schematic diagram of Fig. 1. The hot exhaust gases from the engine evaporate the water, the steam passing to the radiator. From this same line a piping supplies steam to the regulator, which latter maintains a given pressure in the upper portion of the water tank. From the base of

the tank a tube tees into the line connected to the discharge pipe of the radiator. A single line then returns to the lower side of the boiler. When the hot-air mixing valve at the discharge side of the radiator is opened, air passes through the radiator. Next, the steam condenses, giving up its heat of vaporization to the ventilating air. Consequently, a drop in pressure follows on the steam side of the radiator. Steam from the boiler then flows to the radiator, causing a pressure drop in the boiler. As a result, more water flows into the boiler. On the other hand, when the hot-air mixing valve is closed, the radiator no longer condenses steam. Therefore, there is a steady pressure in the boiler which forces the water back into the surge chamber. When only little heat is needed in the cabin, the water surges in the tank, and some enters the boiler at intervals, chilling it.

In the duct system, a tube containing the nose valve at the entrance leads the cold air from the nose of the airplane to the face of the radiator. A duct by-passes a portion of the air around the radiator, and through one of the mixing valves already described. The cold and hot air from the two mixing valves is then channeled into a common duct and conveyed to the fuselage distributing system. As the boiler has insufficient capacity to prevent freezing of the radiator, the nose valve can be partly closed by the pilot in extremely cold weather. An automatic control connected to the mixing valves has been designed to maintain the air at a predetermined temperature. If successful, this automatic control will eliminate the need for a nose valve.

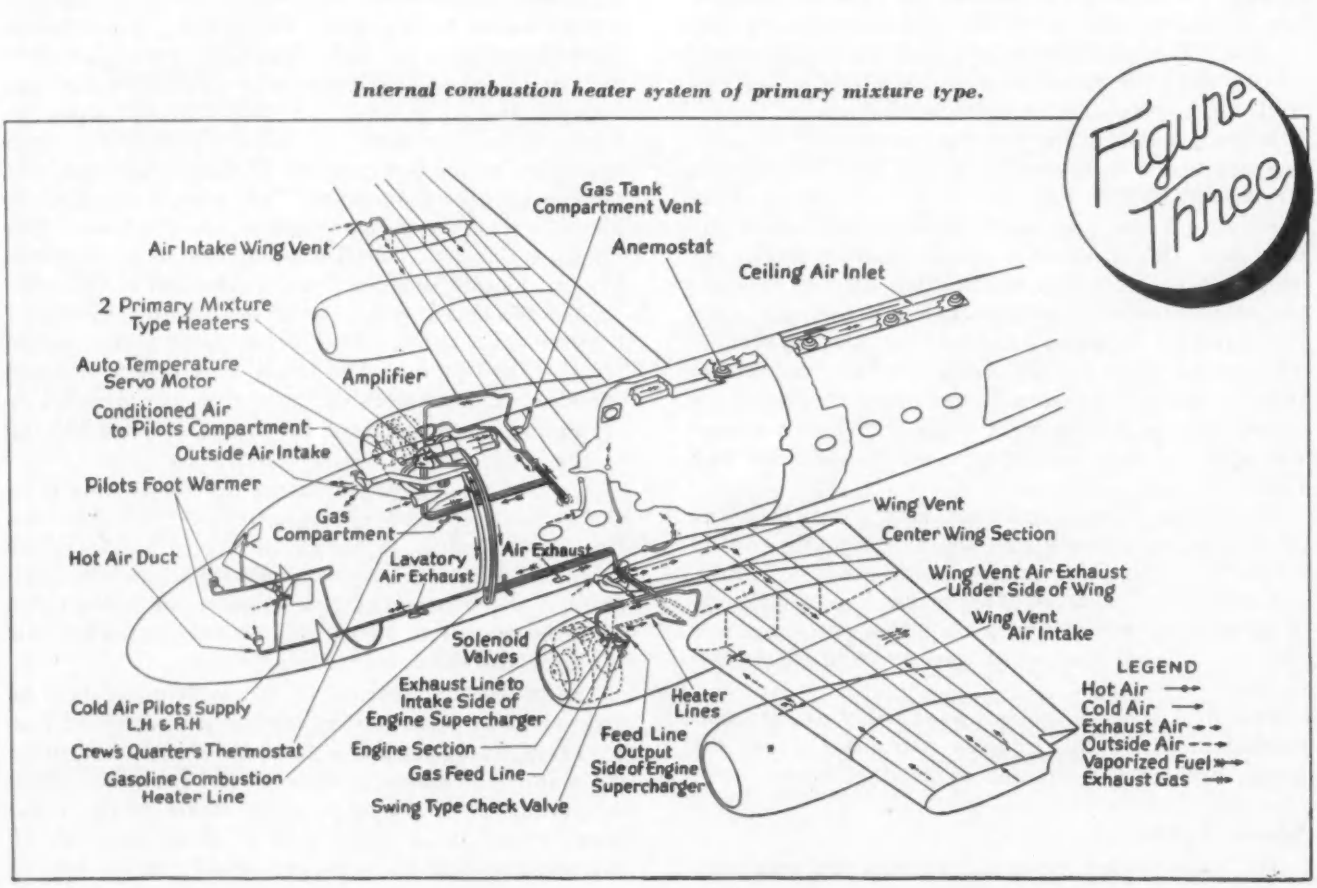
In the past, boiler life has been short, as the inner muff, when made of material sufficiently strong to resist the buckling stress, would collapse. This difficulty has been overcome by making the inner shell of thinner material which is corrugated to withstand the steam pressure. By experiments with a gas burner it was proved that the buckling is caused by stresses created by the temperature gradient across the inner shell.

An investigation of the thermal circuit through the boiler shell revealed that the resistance to heat flow on the gas side is the controlling factor as regards the rate of heat transfer from the gas to the water. The greater the resistance to heat flow, the greater the temperature drop. When the boiler is generating steam at its maximum rate, the metal temperature is only a few degrees higher than the temperature of the steam, and operating constantly under this condition should ensure longer boiler life.

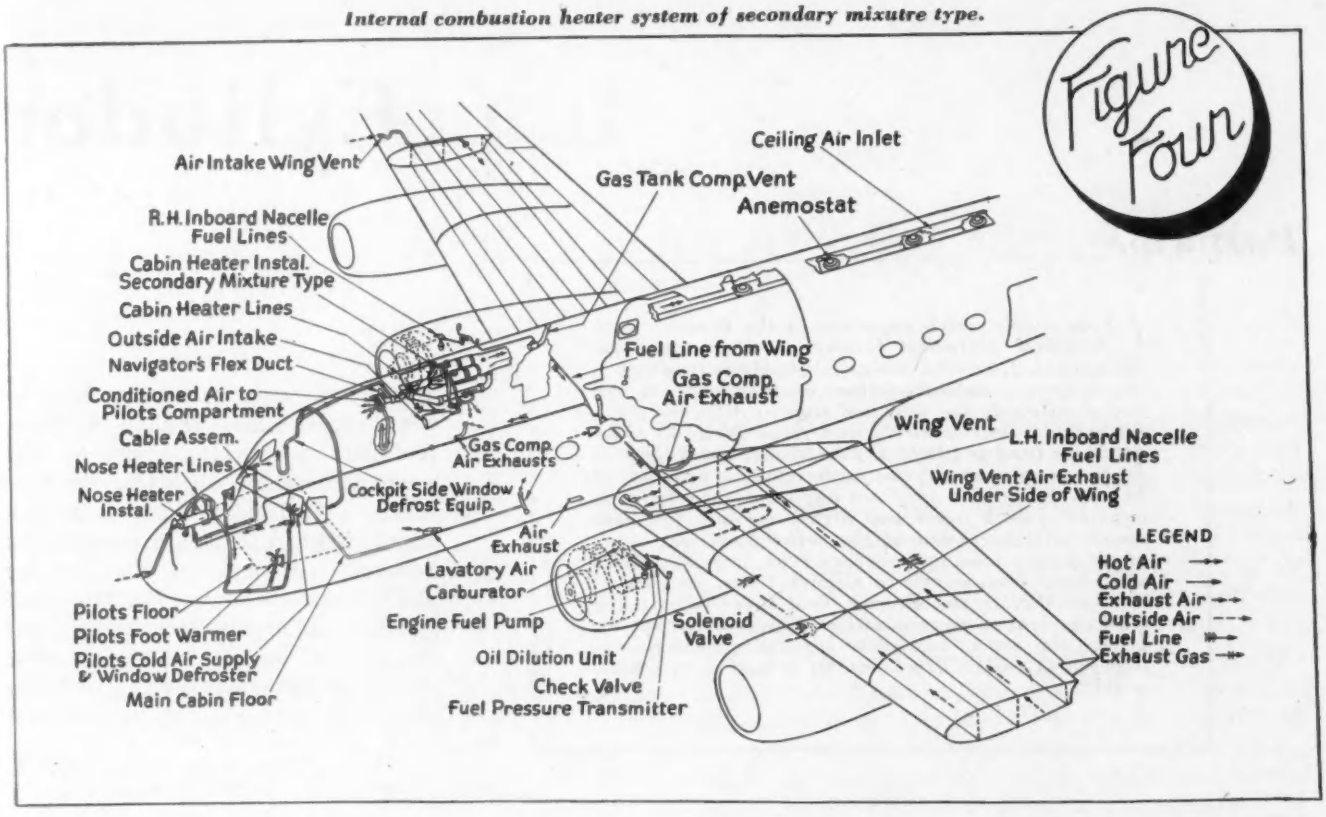
To keep the boiler generating steam, the radiator must be kept condensing steam continually. A dump valve is being constructed to release the heat from the radiator overboard when it is not needed in the cabin. These two changes in the system have not yet been fully developed. Certain operating difficulties have been encountered on the ground where there are no heated hangars to shelter the airplanes, and the system weighs about twice as much as the exhaust hot air type, and about four times as much as the combustion type.

In spite of these disadvantages, the steam system possesses advantages when considered from the standpoint of its possible application in future airliners. It is well known that air contains considerably less

Internal combustion heater system of primary mixture type.



Internal combustion heater system of secondary mixutre type.



moisture at 20,000 ft than at sea level. Consequently, moisture will have to be added to the cabin air to insure passenger comfort when flying at high altitudes. This could easily be accomplished by spraying steam into the ventilating air. A method has been developed by which water can be reclaimed from the exhaust gases, and there is easily sufficient water in these gases for humidification. Another advantage of the steam system is that with it there is no possibility of toxic gases entering the ventilating-air stream.

Exhaust Hot Air Heater System

The exhaust hot-air heating system is considered one of the best systems for use in the Far North, because there is always heat when engines equipped with heat exchangers are running. This type of heating system consists of an air scoop, a heat exchanger in the exhaust pipe, and a duct system. Part of the duct system carries hot air from the heat exchanger and cold air from the air inlet in the nose of the airplane to the mixing chamber in the fuselage. From there the tempered air is taken to the distributing duct within the cabin. Excess hot air is discharged from the airplane. To heat the cockpit, a duct branches from the main hot air supply to a mixing valve, where it can be tempered before entering the cockpit from a tube near the feet of the pilot and copilot. Should an engine be losing an excessive amount of oil, air contaminated with oil fumes can be prevented from entering the cabin by means of a two-way valve.

This system, while seemingly simple, presents design problems in heat transfer, fluid flow, and heating and ventilation. The heat-exchanger air scoop receives its air from the propeller slip stream. The purpose of the scoop is to deliver the necessary air with a minimum loss in the dynamic pressure due to the forward speed of the airplane. For best performance, the velocity in the heat exchanger should be 0.6 the free-stream velocity of the airplane, and the air must be retarded by expanding the duct carrying it to the heat exchanger. To prevent it from collecting engine cooling air which may be contaminated with oil fumes, exhaust gases, and propeller-deicing alcohol fumes, the air scoop is made to project forward of the engine cowl flaps.

During the past five different types of heat exchanger have been developed, as follows: (1) the extended-fin type, (2) a single tube passing through the exhaust pipe, (3) the extended-primary-surface type, (4) a muff surrounding the exhaust pipe, and (5) a bundle of tubes.

The extended-fin type is used where space is restricted, or where the resistance to heat flow is high, because it affords a large heat transfer area in a small volume. Increasing the heat-transfer area is equivalent to decreasing the resistance to heat flow. To reduce the weight, the fins are either spot-welded or furnace-brazed to the primary surface, but these processes do not always ensure perfect metallic contact, and without such contact the fin surface is ineffective. Consequently, the extended-fin type of heat exchanger is often heavy in proportion to the amount of heat it supplies.

The second type, consisting of a single tube passing through the exhaust pipe, is the simplest of all. Usually the tube passes through the exhaust pipe diag-

(*Turn to page* 94, *please*)

Cylinder A

Part One

IN an article which appeared in the German aero-technical periodical Luftwissen *some time ago, the author, J. Smirra, discussed problems involved in the design of aircraft engines of very large output, and particularly the pros and cons of different possible cylinder arrangements with from 30 to 48 cylinders. He used a 4000-hp, four-stroke, spark-ignition engine as an example, but formulated his conclusions in such a way that they are applicable generally, to engines of both lower and higher output. We have rewritten and condensed the article, redrawn some of the illustrations, and converted the formulas, tables and charts from metric to English Units. In view of the fact that in the aircraft field there is a strong tendency toward powerplants of increased output, we believe the article will prove suggestive to engineers engaged in engine development, as well as to others. —Editor.*

THERE are essentially three methods by which a compact layout can be obtained when an aircraft powerplant of very large output is being designed, which may be briefly outlined as follows:

1. By developing existing single-shaft engine types to the required higher power by increasing the number of cylinders, the bmep, and the piston speed.

2. By obtaining the total power required from a number of separate powerplants.

3. By combining a number of engines into separate power units by means of suitable gear or flange couplings.

The target to be shot at having been purposely set beyond present-day limits, every possible use will have to be made of all the most recent experimental results, methods, and data, within the limits of safe current practice, including a high bmep, a high piston speed, a high supercharge, and a high compression ratio, as well as direct fuel injection and pressure cooling. For the bmep —which approximately determines the thermal stresses in engine parts —and for the mean piston speed—on which the mechanical stresses depend

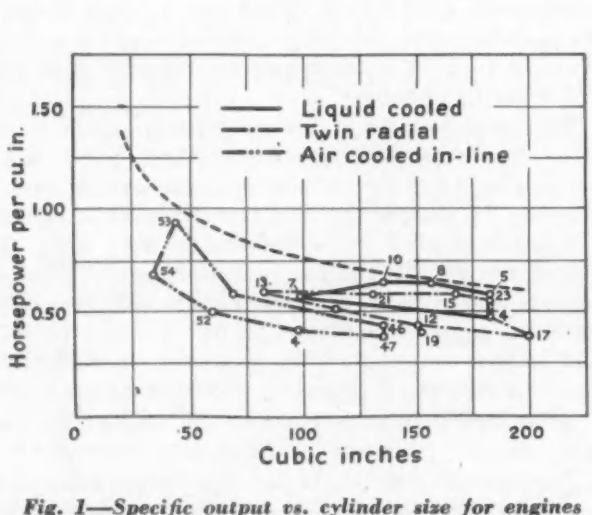


Fig. 1—Specific output vs. cylinder size for engines with a bmep of 200 psi, a mean piston speed of 2750 fpm, and a stroke/bore ratio of 1.1, and for different actual engines.

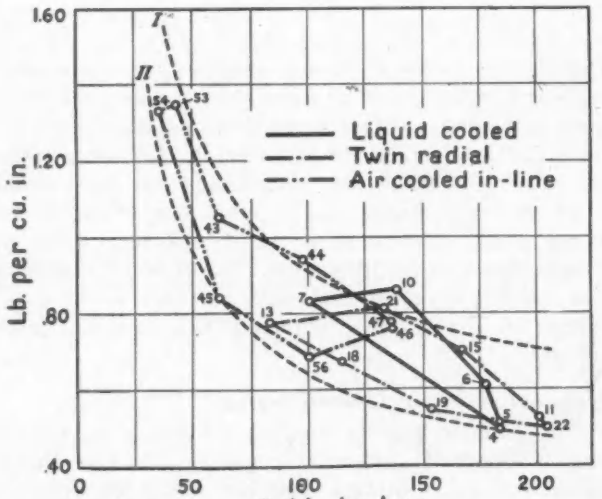


Fig. 2—Weight per cu. in. displacement vs. cylinder size for various actual engines.

—the following constant values have been assumed:

p_e = 200 psi.

c_m = 2750 fpm.

These are the approximate upper limits in current practice. Smaller cylinders would permit of slightly increasing the mep, but not the bmep, because the frictional losses would be greater. For the stroke/bore ratio a constant value of 1.1 is assumed. The author holds it inexpedient to reduce the stroke/bore ratio below this value, with the object of decreasing the specific weight, because this would tend to give an unfavorable compression-space form.

A high supercharge is contemplated because—the

Arrangement

for 4000 Hp. Aircraft Engines

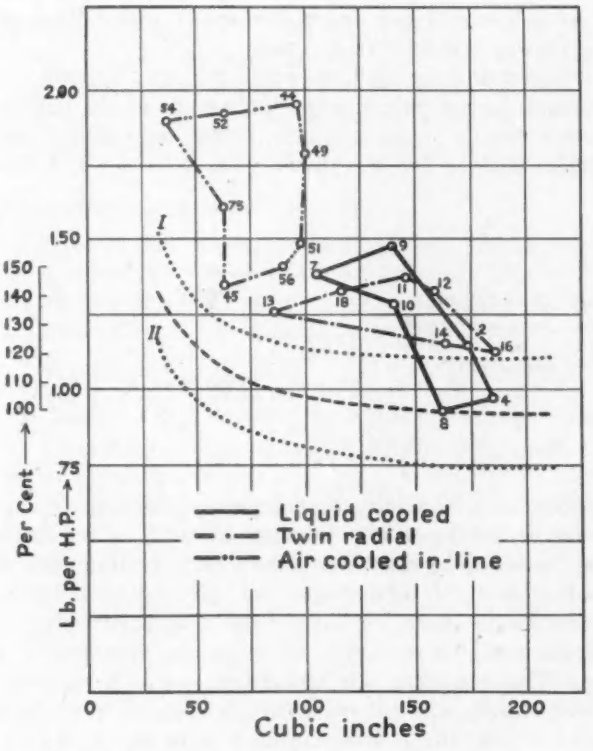


Fig. 3—Weight per hp vs. cylinder size.

same as a high compression ratio and the use of high-octane fuel—it increases the bmep. Reduced economy owing to the disuse of the very high expansion peak of the ideal diagram need not be feared, since the exhaust energy can be used to advantage in a turbine, and will tend to indirectly increase the bmep, by restoring the power which otherwise would be lost in a mechanically-driven blower. Besides, at modern air speeds, exhaust-jet propulsion is quite feasible, and, lastly, some exhaust heat is always needed for wing de-icers and pressure cabins.

Direct fuel injection is contemplated because it gives the immediate advantages of increased bmep, reduced fuel consumption, and reduced fire risks, and because it simultaneously solves the carburetor problem and the problem of mixture distribution in multi-cylinder engines.

Number and Size of Cylinders

Cylinder bore and number of cylinders are determined by considerations of the possibility of air-cooling and freedom from breakdown—the latter depending also on the number of throws and layout of the crankshaft—but principally by the specific weight. Liability to breakdown appears to increase faster than the number of cylinders, owing to the progressive multiplication of parts in the engine. The possibilities of varying the engine layout by varying the number of cylinders are restricted, however, by the requirement of symmetry for in-line engines, and considerations of layout generally.

The relationship between the cylinder bore and the specific weight cannot be conveniently expressed in any generally-valid form, but it will be investigated on the basis of statistical data. For the specific weight itself a practically-useful expression can be readily found. By this means an analytical factor for one of the design constants can be applied to the empirically-determined relationship between the specific weight and the cylinder bore. With reduction of the cylinder dimensions, the geometrical component of the reduction in length (the piston stroke), causes the output per unit of displacement to vary inversely when the following basic equation is used:

$$\text{Hp} = \frac{V\, p_e\, n}{792{,}000}.$$

Let

N, the maximum output be 4000 hp;

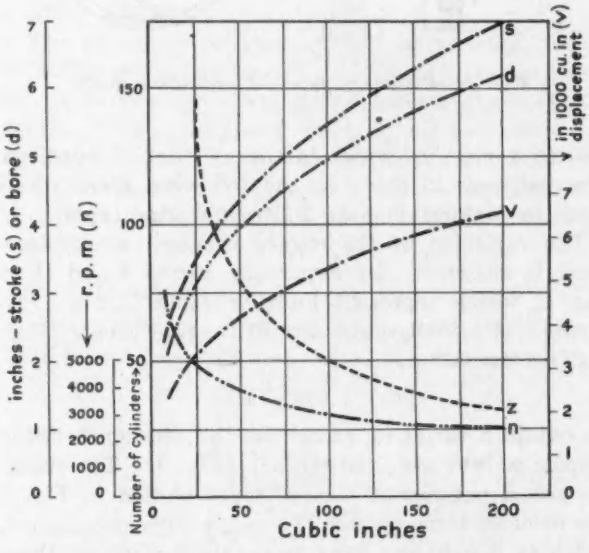


Fig. 4—Stroke, bore, total displacement, cylinder number and rpm vs. cylinder size for a 4000-hp powerplant with a bmep of 200 psi, a mean piston speed of 2750 fpm, and a stroke/bore ratio of 1.1.

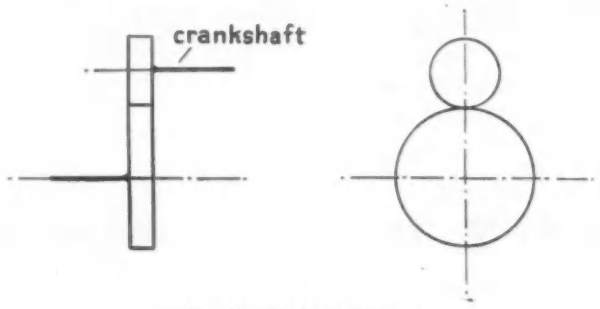


Fig. 5—Reduction gear.

p_e, the bmep, 200 psi;
c_m, the mean piston speed, 2750 fpm;
s/d, the stroke/bore ratio, 1.1;
$V = V_h \times z$, the total displacement of the engine;
V_h, the displacement per cylinder;
z, the number of cylinders;
n, the crankshaft speed in rpm;
s, the piston stroke in in.;
d, the cylinder bore in in.

Then the output per unit displacement is given by the equation

$$\frac{N}{V} = \frac{4.166}{s} = \frac{3.608}{\sqrt[3]{V_h}} \text{ hp per cu. in.}$$

This equation for the specific output is plotted in Fig. 1.

Owing to the high assumed values of p_e and c_m, the curve corresponds substantially to the upper limit of output, as shown by the comparative curves for a number of engine types in the same diagram. It confirms the empirical deduction that the output per unit

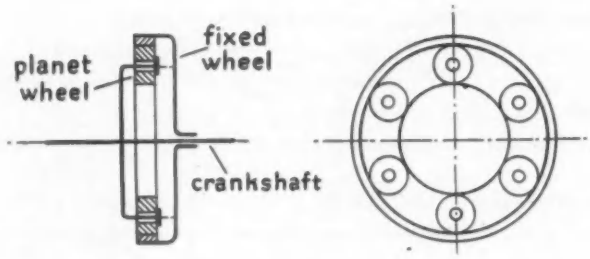


Fig. 6—Planetary type of reduction gear.

volume varies inversely as the cylinder dimensions. The polygons in this and the following illustrations refer to performances of different engine types.

The variation of the weight per unit of displacement is shown by the hyperbolic curves I and II in Fig. 2, which represent limiting values for a great number of actually-built aircraft engine types. Eliminating the factor.

$$G/V : N/V = G/N$$

we obtain a series of values for the relation between specific weight and cylinder size (Fig. 3). The values for actual engines of various types plotted in Fig. 3 are in most cases outside the range thus determined, which is due to the more moderate loading of these engines. It will be seen that generally an increase in cylinder size from 120 to 200 cu in. has only very little effect on the weight per hp. The advantage of an increase in output per unit displacement with a decrease in the cylinder size is thus largely lost as a result of the accompanying increase in weight per unit of displacement, which causes the weight per hp to remain constant over a considerable range of cylinder sizes, although it increases rapidly for cylinders of less than 60 cu in. displacement. This points to a certain latitude in the selection of the cylinder number. Suitable values for cylinder number, together with accompanying values for other design constants, based on the considerations and principles set forth in the foregoing, may be found from Fig. 4. Since the factors plotted in Fig. 4 are based on high fixed values of bmep and piston speed, air-cooling will be impractical in certain cases.

High flying speeds have made the drag a more important factor than the specific weight of the engine. Large frontal areas are permissible only under special conditions for very large powerplants, which fre-

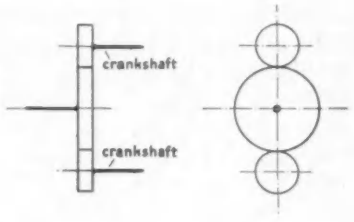


Fig. 7 — Collector gear for two crankshafts, with speed reduction.

quently will be partly or completely enclosed in the wing or fuselage, so that they have no direct effect on the drag. From the standpoint of drag, liquid cooling has the advantage over air-cooling in large powerplants. With the former the drag is not affected by the radiator required, which can be arranged as a jet radiator back of the powerplant, or as a wing radiator which will not increase the frontal area. In a general way, the in-line engine is superior to the radial in this respect, and of the latter class the single-row type has the advantage over the multi-row. For the same reason, the arrangement of multiple engine units in parallel has nothing to recommend it.

While the frontal area is important because it determines the drag, the over-all dimensions, that is, the space requirements, are the dominant factor in the design and installation of a powerplant. For a submerged installation in a wing, for instance, flat engine types, such as horizontal-opposed and horizontal H engines, are specially suited. Radial engines arranged in series, that is, lying flat inside the wing, would also appear feasible.

The space requirements of an engine unit depend chiefly on the crankcase, cylinder block, gearcase, auxiliaries, and the feed pipes. Parallel arrangement

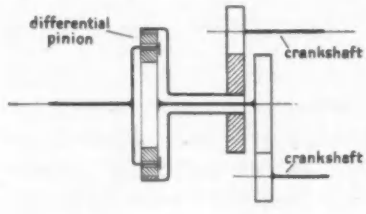


Fig. 8 — Differential type of collector gear for two crankshafts, with speed reduction.

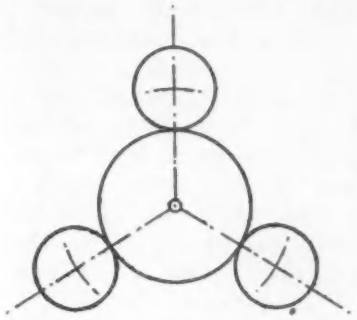


Fig. 9 — Collector gear for three crankshafts, with speed reduction.

of several crankshafts has surprisingly little effect on the space requirements, but the tandem arrangement does not permit of a compact layout. Of course, compactness may have to be sacrificed in the interest of accessibility and convenient servicing.

Crankshaft and Main Bearings

In discussing the crankshaft layout, consideration must be given also to the propeller-drive problem. Concentration of the total power in a single shaft will not meet the requirements of counter-rotating propellers, in the case of which an intermediate gear will be required, which will add to the weight of the plant. The need for an even number of crankshafts in a multiple arrangement is indicated by the following considerations:

Two crankshafts eliminte the need for intermediate gearing to produce counter rotation, and also—if torque balancing is omitted—for a differential gear.

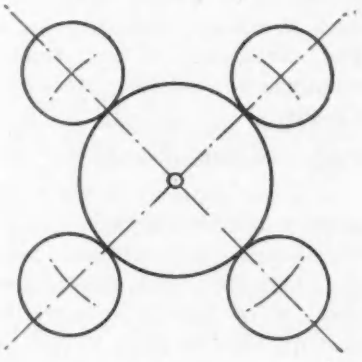


Fig. 10 — Collector gear for four crankshafts, with speed reduction.

Counter rotation is most simply effected by running the two engines in opposite directions (Fig. 11). The same holds true for four crankshafts, in the case of which, moreover, the engine units may be made to work in pairs on a single propeller through a single drive gear. (Fig. 12.) Three crankshafts are less favorable even than a single one, as the torques would have to be combined and balanced before being divided between the two propellers. From the standpoint of structural strength, the multiple-crankshaft arrangement is most favorable, and it also is the best means of obtaining individual units suitable for air-cooling. The possibility of stopping and cutting out an individual unit ensures the greatest reliability in operation, and the advantage of interchangeability of standard engine units in case of a partial breakdown is obvious.

For in-line engines the practical maximum is two shafts, or two pairs of shafts. For radial engines, owing to the comparative shortness of the crankshaft, a three-in-line layout would seem to be a possibility.

Difficulties in the design of long, multiple-throw crankshafts arise principally from the need to avoid torsional vibration. All possibilities in this respect have not yet been explored fully. The weight of long engines obviously must be quite high, as besides the necessarily increased strength and rigidity of the crankshaft and crankcase, the pipe lines and their contents increase the weight to a greater extent than with side-by-side engines. In this discussion, in order to cover the field fully, crankshafts with from 4 to 12 throws will be considered.

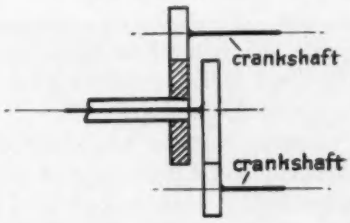


Fig. 11 — Drive for counter-rotating propellers from two crankshafts, with speed reduction.

Loading and space requirements of the main bearings depend on the engine power. Roller bearings have the advantage over plain journal bearings that they are less sensitive to temperature and lubricating conditions. Furthermore, they can be specially designed and dimensioned for any desired service life. There are no restrictions on their installation, as the problem of sub-division of the bearing race has been solved. Roller bearings therefore should be specified in all new designs. The use of roller bearings materially reduces the risks of pitting and heating, and a centralization of the lubricating system should be aimed at, because of the saving in weight made possible thereby.

The transmission gear, which includes all devices by which power is transmitted from the engine crankshafts to the propeller, must perform the following tasks: Reduce the speed, combine the torques of two or more engine units, connect up or cut out individual units, divide the total power between the two propellers, and ensure their rotation in opposite directions (counter-rotation).

Speed Reduction

Of the types of spur and level gearing with planetary pinions or internal gears, the latter are more

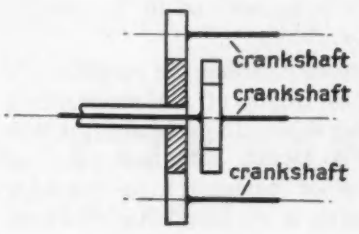


Fig. 12 — Drive for counter-rotating propellers from two collector gears driven by two crankshafts each, with speed reduction.

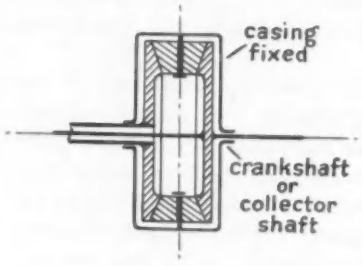


Fig. 13 — Counter-rotating distributor gear.

suitable where torque coupling and speed reduction must be combined (Figs. 7, 9, 10 and 12). In other cases speed reduction usually can be effected at points where gearing is required for some other purpose—torque coupling or counter-rotation. The choice between speed reduction by means of a single, separate gear train or in a number of successive stages—possibly in combination with torque coupling, power distribution, or change of rotation—will depend on considerations of mechanical strength, heat stresses, and structural weight, aside from the design factor of the number of shafts.

In multi-engined powerplants the combination of the outputs of the individual engine units by a single transmission gear is essential only in the case of triple engines. Propeller drive through a transmission gear common to a number of engines adds to the weight, since the counter-rotating propellers will require a further, separate distributing gear, which will have to be designed for high-power take-off. With a twin-engined layout driving two propellers, torque coupling can be dispensed. (Fig. 11.) If one engine fails, the corresponding propeller can be feathered, the reliability in that case being no less than with coupled engines, with which the two propellers would have to share the torque of the remaining, sound engine. Quadruple engines can be most conveniently coupled in pairs, to avoid the need for a separate distributing gear, reliability and continued operation with one engine cut out being assured in the manner already described. (Fig. 12.)

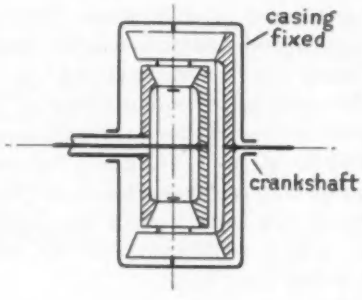


Fig. 14 — Counter-rotating distributor gear with speed reduction.

The most obvious way to combine the outputs of a number of engines is by means of pinions meshing with a gear on the driven shaft. In designing the separate couplings for this layout, attention must be given to the possibility of periodic high-frequency vibration when the engine is running. An alternate, more complicated arrangement consists in the use of a differential gear. For a two-shaft coupling the arrangement is somewhat simpler (Fig. 8). A differential gear affords the advantages of better control of vibration, higher overall efficiency of the coupled engines (since there is no interference from a difference between the speeds of the engines), and the possibility of replacing coupling clutches by simple brakes for cutting out individual engine units. The disadvantages are much greater weight and reduced reliability.

Combination of engine units of types tested in single drives, as a means of obtaining extremely high powers, presents the additional advantage of increasing the operating reliability, as it makes it a simple procedure to cut out a broken-down unit. This, of course, implies the provision of a coupling and selective switching mechanism, and the latter must not itself increase the risk of breakdowns. Easily-solved problems in this connection relate to free-wheeling, rigid coupling with definite crank angles to reduce torque fluctuations and shaft vibration, and automatic or manual selection by means of centrifugal, hydraulic, pneumatic, or electro-magnetic units. The advantages of a differential gear with brake couplings for selective switching have been outlined already.

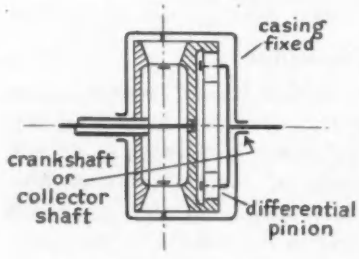
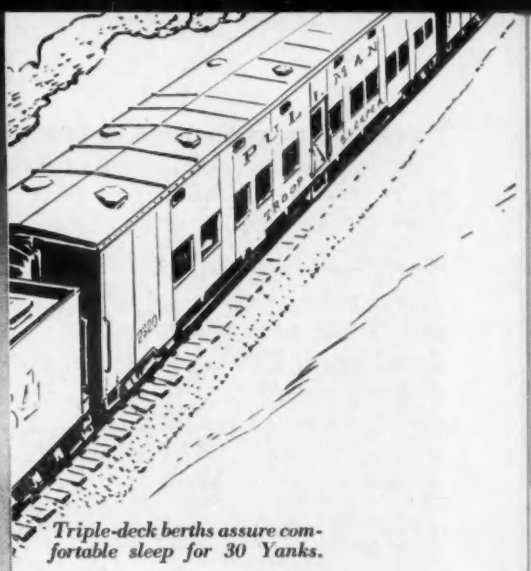


Fig. 15 — Counter-rotating differential distributor gear.

Power Distribution

If power coupling is not resorted to, with an even number of crankshifts and only two driven shafts, no separate distributor gear is necessary. (Figs. 11 and 12.) However, with single- and triple-engine assemblies, where this is impossible, if the interposition of a differential gear should be undesirable, the division of the total power between the two propellers can be combined with the mechanism for counter-rotation (Fig. 13). With a single shaft, speed reduction can be combined with power division in the same gearing, provided the reduction ratio is not too great (Fig. 14). The required division of the power by way of a number of gear wheels is here provided naturally by reason of the high torque to be transmitted. Power distribution, as well as power combination (torque coupling) can be effected by means of a differential gear, with the same advantage of increased efficiency, due to the absence of interference between the two propeller drives.

As a differential distributing gear—in contrast to other types—does not permit of simultaneous reversal of the drive (counter-rotation), the reversal of the



Triple-deck berths assure comfortable sleep for 30 Yanks.

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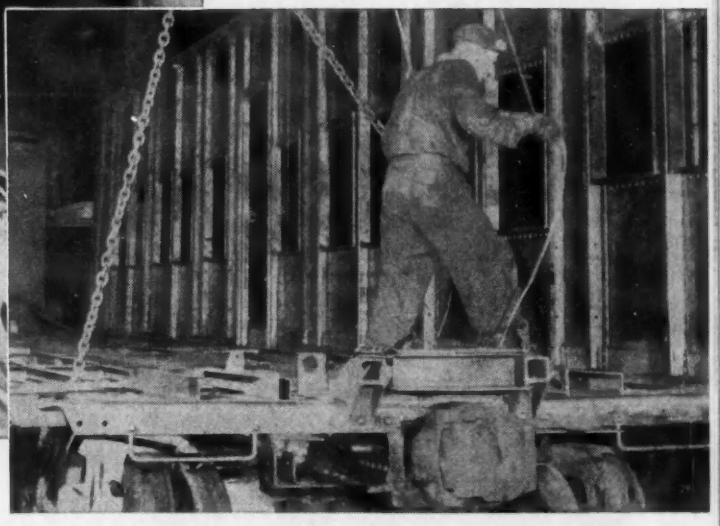

Victory Special

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Each car has 30 berths arranged in tiers. The triple width seats are grouped in sections on one side of the car. For daytime use the top berths remain fixed. The back of the wide, comfortable seat is raised into position for the second berth, and the seat itself forms the lower berth. Each car will have its porter, and a full complement of standard steel bed springs, mattresses, warm blankets, sheets, etc.

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torque of one engine must be effected by means of a separate gear (Fig. 15). This gear can be conveniently located immediately beyond the differential gear, but the additional weight is appreciable.

Gear Combinations

Possible gear layouts are shown in the following table, which includes only combinations that are practical from both the economic and the technical points of view.

POSSIBLE GEAR LAYOUT

Object	Solution		Fig.	Remarks
(1) Speed Reduction	(11) Fixed wheel		5	1 shaft
	(12) Planet wheel		6	
(2) Power Coupling	(21) 2 shafts	(211) Rigid gear	7	With speed reduction
		(212) Differential	8	
	(22) 3 shafts		9	
	(23) 4 shafts		10	
(3) Power Distribution	(31) Primary	(311) 2 shafts	11	Speed reduction + Counter-rotation
		(312) 4 shafts	12	Speed reduction + Power Coupling and Counter-rotation
	(32) Secondary	(321) Rigid gear	13	With counter-rotation
		(322) Rigid gear with speed reduction	14	
		(323) Differential	15	Counter-rotation by a separate gear.

Practicable gear layouts on the basis of the above possible combinations are listed in Table 1, in which the gears are placed in the order of suitability for different numbers of cranks, evaluation being governed principally by considerations of low weight and reliability.

TABLE 1

Number of Crankshafts	ORDER OF MERIT			
	I	II	III	IV
1	322	1 + 321	1 + 323	
2	311	211 + 321	211 + 323	212 + 321/323
3	.....	22 + 327	22 + 323	.....
4	372	23 + 321	23 + 323	.....

As already pointed out, the valve gear can be of any conventional type. In view of the great number of cylinders, an "overhead" camshaft, driven through an intermediate shaft (or through two intermediate shafts in the case of specially long engines) probably will be the most practical arrangement.

The blower can be either mechanically-driven or of the turbo type. In addition to multi-speed and multi-stage operation, the provision of several blowers brought into operation successively, is a possibility which should not be overlooked. However, a single, large blower will weigh less than two blowers of the same aggregate capacity.

Exceptionally large powerplants offer particular advantages in that they permit cutting down the weight of auxiliaries, by providing auxiliaries serving a number of individual engine units. The same as in the case of supercharging and lubricating arrangements, centralization can effect economies also in the pneumatic, hydraulic, and electric transmission systems, and in all auxiliaries handling liquids or gases. It is not applicable to such essential elements of individual engines as the ignition and fuel-inection systems. The occasional requirement of a power take-off from the torque-coupling gear may necessitate important modifications in the layout and type of the auxiliary machinery.

With increase in the number of cylinders, greater difficulty is experienced in accommodating the induction, exhaust, and fuel-injection piping, the governor mechanism, couplings, clutches, control levels, gears, valve shafting and auxiliaries, and the feed systems for the working media. The possibility of air-cooling large engine units depends principally on a suitable layout of the auxiliaries.

Increasing dimensions and output of modern aircraft powerplants not only impose increasing demands with respect to the control of inertia forces, but also require that attention be given to the problem of engine mountings, as regards both their structural details and the space required. The most promising approach to a statically fully indeterminate system of engine bearers with the fullest possible load distribution has been realized already in individual cases, by suspending two-row radial engines by the cylinder heads and incorporating the cooling baffles with the engine bearers, which results in a considerable saving in weight. If this development is continued, the engine bearers will become increasingly incorporated in the airframe structure.

End of Part I. Part II will appear in an early issue of Automotive and Aviation Industries

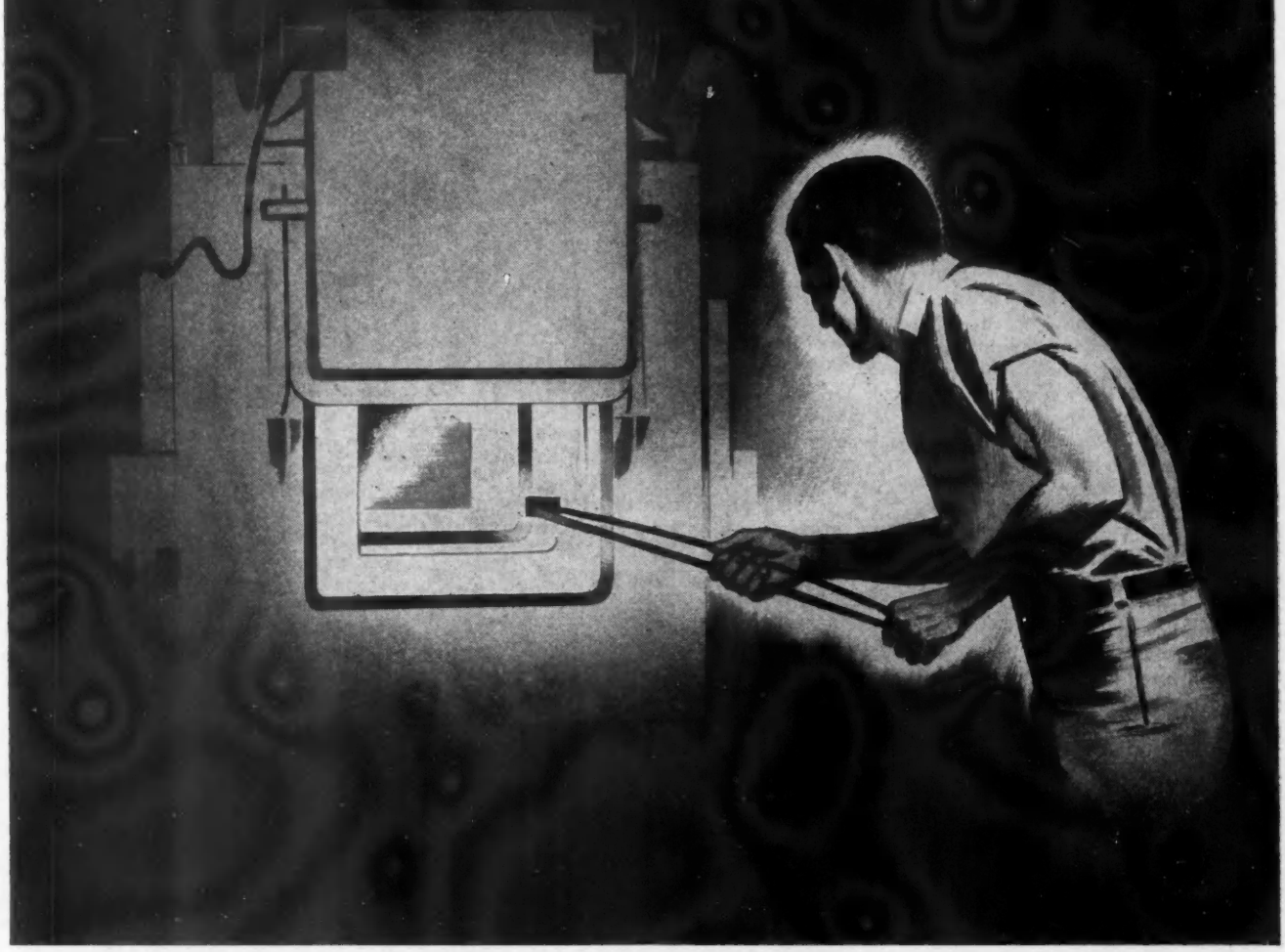
Timken Subsidiary in South America

To service the millions of Timken Bearings now operating in South America—and to anticipate a great postwar acceleration of industrial growth there—The Timken Roller Bearing Company has organized a subsidiary, The Timken Roller Bearing Company of South America. After the war, under the direction of Jules A. Morland, the new firm will handle engineering development of Timken products in the Latin-American countries below the border.

As part of its organization program, Timken now has two young Brazilian engineers, Murillo Garcia Moreira, 24, of Rio de Janeiro, and Jose Marianno Chaves, 26, of Sao Paulo, in its Canton plant, where they are familiarizing themselves with the engineering production and application of Timken Roller Bearings and Steel. They are later to spend a period of time in the Mt. Vernon plant of The Timken Company where rock bits are being manufactured.

In describing the move, Whitley B. Moore, Timken general sales manager, said that in the past the company conducted its business there entirely through South American distributors, whose primary function was to handle replacement bearing trade and who will continue in this capacity.

Proper Identification of High Speed Steels Saves Time



Plants using both tungsten and molybdenum types of high speed steels should give serious consideration to the establishment of an efficient identification system—one that will keep the steels separated from bar stock to finished tool.

The danger of spoilage is particularly acute when mixed lots get into the heat treaters' hands.

The recommended hardening temperatures for tungsten types are 100° to 200°F. higher than those for the molybdenum types. Treating the latter so far above recommended temperatures will spoil them for cutting tool service. Treating the tungsten types that far below recommended hardening temperatures will not develop the required red hardness.

Heat treaters sometimes use the "sweating" of tungsten types as an indication that the steel is up to proper hardening temperature. *THIS DOES NOT HOLD WITH MOLYBDENUM TYPES.* In their case, a pyrometer should always be used to determine when the steel is at the recommended hardening temperature.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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MOLY

Airbriefs

By Henry Lowe Brownback

Water

As long as I have been connected with the design and manufacture of gasoline engines I have heard the old argument as to whether moisture helped an engine or not rave on. Most of you have seen all sorts of trick catch-penny devices which were supposed to draw water into the mixture either through little sprays or else by sucking vapor out of the radiator header, but all anyone could get from them were gummed piston rings or stuck valves. At one time I was much interested and made some tests in Europe, which clearly indicated that water injected at the right point in the combustion cycle had a most beneficial effect. It has therefore, been interesting to see one of the world's leading manufacturers come out with water injection to control detonation and exhaust valve temperatures and thus increase power.

Water injection is also proposed in connection with so-called fuel rockets, really jet propulsion. It has long been used with the combustion turbines in marine torpedoes and its future use in all sorts of combustion engines is most interesting.

Danger

To talk of danger in connection with aviation is like waving a red flag at a bull. It may be that thoughts of danger lurk in the back of the minds of many aviation men and produce the same reaction as talking earthquakes or hurricanes to the Los Angeles and Miami Chambers of Commerce, respectively. Actually, anything which goes fast is dangerous and the faster it goes the more dangerous it is if it runs into something!

It is useless to say that airplanes, as they have been designed, are not dangerous unless handled by very unskilled men because the accident record shows it if time in the air and not miles run is taken as a yardstick. Motor cars, trains and ships have taken their toll and the lessons learned in those fields should be a lesson to the airplane designer. In all of them the incorporation of safety factors have saved countless lives.

Many old-time airplanes could get in severe crashes without hurting the occupants severely because, as the designer of one of them said to me, there is so much to break up and soften the shock before the occupants made contact that there was less danger than there would have been with "cleaner" planes.

With all this in mind the futuristic designs of some industrial designers are disturbing. Nearly all show some tear-drop structure shorn of anything which might cause resistance with a seamless clear plastic bay window nose in which the hapless occupants are seated. This holds for motor cars as well as airplanes.

Mr. DeHaven at Cornell has made an exhaustive study of aircraft accidents and he stated in a 12th Annual Meeting Paper of the Institute of the Aeronautical Sciences:

"Designers, for example, must eliminate the fragility and egg-shell collapse from semi-monocoque plywood construction. Fuselages must be rugged and resilient and hold together in a crash. Forward seating and involvement with structural collapse should be avoided. If the head is stopped by the instrument panel while the body surges forward or held at the hips by a seat belting, the most disastrous, fatal and spinal accidents emerge." It is good to see studies of this kind being made and it is to be hoped that all of our future vehicles will not be designed only to operate under normal conditions, but to permit their occupants to survive the accidents which are bound to occur in the operation of mechanical vehicles. This can be done and performance obtained at the same time. When the Army Engineers designed a fast outboard boat they were not content to make something which ran well in water but perfected a boat which could strike the bank at full speed with ten men up, leap clear, smash down on the ground and slide for forty feet without hurting either the boat or the men. It took courage and originality to do this, but the Engineer Board did do it and so can many designers in many lines, particularly in aviation, which will live or die by the amount of safety it can offer to travellers and private owners.

Servo Controls

Some of my flier friends tell me that many of our present day airplanes require a degree of physical strength to operate the controls which few men possess. Before I left France just before the outbreak of the war, one of my friends showed me a most remarkable layout of servo controls, hydraulically operated, for use in motor vehicles, particularly trucks and buses. The servo controls worked the brakes, clutch, gears and steering. He then showed me a similar layout for the operation of the controls on aircraft using oil at tremendous pressure. The beauty of the whole thing was its utter simplicity and light weight. I have seen statements that weight saving is worth $1.50 per ounce in bombers and that it costs $100 per pound per year to lug extra weight in a passenger plane. It is therefore amazing to see some of our planes all cluttered up with miles of wire, many little electric motors and complicated little reduction gears all requiring heavy batteries and generators and costing a young fortune and comprising everything from engine starters up and down when extreme high pressure hydraulic devices will do the same thing and weigh and cost less.

Surfaces

I heard a story a few days ago which bore out some experience which I had and which gives food for thought. It had to do with a fast boat, but might have value in connection with planes. A certain boat builder constructed a fast boat for the war from plans furnished by a firm which prided itself on its perfection of detail. The rudder was a marvel of streamlining and constructed along most modern lines. The great day arrived and the boat tore over the water but would not turn properly. Calculations were checked and the whole installation gone over, but still the boat would not steer. The boat builder was an old racing man with a wealth of practical experience and about as much theory as one gets running boats all over the lot and then discussing them to the tune of streams of tobacco juice hitting exactly the right spot on the pot-bellied stove in the boat shop all winter. He suggested that the perfect rudder be thrown away and a piece of boiler plate substituted. The designers protested, but he finally won his point and the flat plate was tried. It raised some "Rooster Tail," but the boat steered perfectly. Don't get me wrong, I do not mean that refined design and properly applied theory are not basic essentials of any technical design, but they must be mixed with large doses of past experience.

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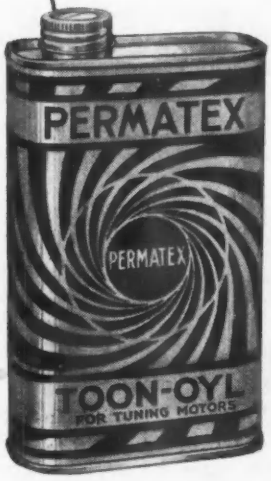
Permatex Toon-Oyl cleans and lubricates clogged piston rings and sticky valves . . . Stops motor "buck" and ignition "ping" . . . Increases pick-up and power.

For smoother, more satisfactory performance, urge car owners to include a quart of Permatex Toon-Oyl in each oil change.



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Dealers Franchises *Stage Comeback —In Big* Demand Today

By E. L. Warner, Jr.

THE gold rush to cash in on wartime savings and pent-up consumer demand in the postwar period has been under way for some months. But the prospectors are not bound for California or the Klondike with a grubstake. Rather, they are deluging the sales offices of the automobile manufacturers with letters seeking franchises for postwar distribution of motor vehicles. Dealerships whose equipment was being sold at 20 cents on the dollar shortly after Pearl Harbor are now considered a gilt edge investment that will prove a bonanza when peace comes and automobile production is resumed. The applications for dealer franchises far outnumber the total vacancies that are available.

Predictions of dealer mortality when the United States entered the war have proved unduly pessimistic. The decrease in dealers has been only 18½ per cent in two years of war, according to the Chilton Co. trade list. The 40,537 new passenger car and truck dealers in January, 1942, had declined to 33,000 by February of this year. However, on a business volume basis the decline has been even less than 18½ per cent, because many of the casualties have been small associate dealers of the marginal variety. Most of the established and well capitalized dealerships have survived and made money in the war period thanks to concentration on service and some used car sales. Dealer mortality was fairly high in the first year of war, but now it has tended to level off and there have been few franchise changes in the last six months unless it be for reason of death or retirement due to poor health. The vast majority of dealers, even the few who have lost money, are looking forward to the volume sales they anticipate when cars are manufactured again.

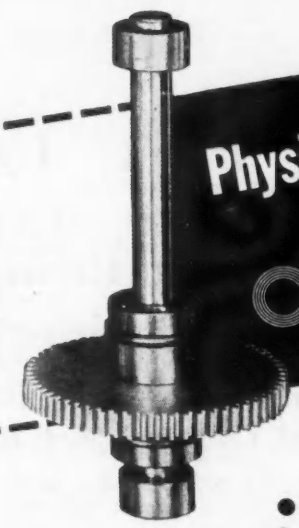
Letters seeking dealer franchises which have flooded sales offices range from the haberdashery clerk in Brooklyn who would like to go into business for himself to the lawyer in Los Angeles who represents a wealthy client looking for a good postwar investment. Some of the letters obviously are from persons lacking either the capital or the experience to make a success of automobile retailing, but who have been attracted by the talk of big profits in the postwar automobile market. However, there are others from persons well qualified from both a financial and a practical viewpoint. The latter include sales and service managers for other dealers who have secured financial backing, as well as regional and national automotive sales executives who want to go into business for themselves. There also are inquiries from established dealers who want to add an additional line, from dealers who want to change lines, from retired dealers who want to reenter the business and from successful salesmen in other fields. Some men in the armed services have inquired about dealerships, but unfortunately few of them have the necessary capital. Other things being equal, a returned veteran undoubtedly would receive preference from a manufacturer.

Most of the companies are waiting until some definite Government policy on resumption of passenger car production is formulated before granting new franchises on terminated dealerships. The companies can afford to be selective in their choice of dealers due to the large volume of applications and the relatively low mortality rate. They also want to determine how permanent are the nation's wartime shifts in population. Cities like Mobile, Ala., Norfolk-Portsmouth, Va., San Diego, Cal., Wichita, Kan., Washington and San Francisco have experienced population increases of more than 25 per cent since the 1940 census. Los Angeles has added 378,292 inhabitants and Detroit has seen an influx of 238,292 persons in 3½ years. Some of these population shifts will leave an imprint on the postwar distribution of goods, including automobiles. States like Oklahoma, North and South Dakota and Montana have lost 15 per cent or more of their population since 1940. Much of this shifting population is of the migrant variety that will go elsewhere when war plants and shipyards close down and other Government construction projects suspend activity. But a certain percentage will remain in new locations. The automobile companies are studying these trends and will grant additional franchises as local conditions warrant.

However, it is unlikely that there will be a return to the lush and carefree days of 1928-29 when companies were overgenerous with franchises and then saw a wave of dealer terminations as the depression of the early thirties reduced car sales to one-fourth of the boom year totals. Total car and truck dealers dropped from a high of 52,588 in 1930 to 35,265 four years later, a mortality of 33 per cent. Meanwhile, new vehicle sales dropped 71 per cent between 1929

(*Turn to page* 200, *please*)

CORROSION is ONLY the HALF OF IT



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● The war has taught us how indispensable Stainless Steel is for thousands of vital operating parts that *must* battle corrosion and heat.

And the outstanding war performance of modern weight-saving Carpenter Stainless Steels is dramatic proof of this metal's exceptional physical properties—its positive corrosion resistance—extra hardness—scale resistance—high strength/weight ratio, etc. At the same time, production men know from war experience that they can meet high output schedules, and do it economically, because of the easier working properties and high uniformity of these Stainless Steels.

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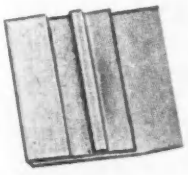
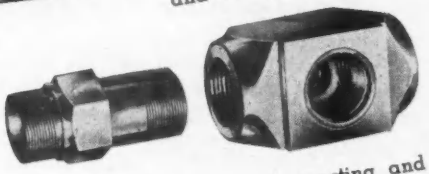


Complicated forming and bending operations can be done more *easily* and more *accurately* with uniform Carpenter Stainless Strip. And this Stainless will help you reduce costs on today's and tomorrow's jobs.



These valve parts must be free-acting and give long, continuous service on the job. Free-Machining Carpenter Stainless No. 5 met these requirements and cut fabricating costs to a minimum.

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Ask for your copy of this 98 page cross indexed working data book. It is free to Stainless users in the U. S. A., and is designed to simplify the selection, engineering and fabrication of Stainless Steels. Write us a note on your company letterhead indicating your position, and we will be glad to send this useful information to you.

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Allison Division of GM Producing 3000-HP, Liquid Cooled Engine

Ninety-seven Per Cent of the Parts in New Allison Engine Will Interchange with Those in 12-Cyl. Model

Allison Division of General Motors has announced that it is in production at Indianapolis on the V-3420 engine, a 24-cyl. liquid-cooled engine that develops approximately 3,000-hp, making it the most powerful airplane engine in the world. The new W engine has twice the piston displacement of the standard Allison V-1710 series which powers the P-38, P-39, P-40, P-51 and A-36 fighter planes. It will increase the engine power of the majority of AAF single engine fighters by several hundred horsepower. Ninety-seven per cent of the parts are interchangeable with the V-1710 engine. A definite decrease in the weight per hp. has been achieved, which in the V-1710 was less than 1 lb. per hp. The W engine not only can be installed in the conventional fighter plane nacelle but it has been specifically designed for "buried" installation in the wings of large planes, such as bombers and transports, with consequent decrease in drag. Developmental work on the V-3420 engine began in 1937, then was shelved temporarily but finally resumed and the engine underwent AAF tests successfully at Wright Field in June, 1943.

The Ford Willow Run bomber plant, which produced 57 more B-24 bombers in March than called for by AAF schedules, is slated to produce only planes for flyaway delivery starting this summer. Heretofore, about 40 per cent of Willow Run's output has been shipped in knock down form via huge highway trailers to plants in the Southwest for final assembly. More than 1,700 B-24 airframes have been shipped thus to the Douglas plant at Tulsa, Okla., and the Consolidated-Vultee plant at Fort Worth, Tex., while several hundred other knock down bombers were hauled to the Consolidated-Vultee plant at San Diego for assembly there. The plants at Tulsa and Fort Worth are due to be converted to production of B-29 bombers. All Ford's B-24 output thus will be flown away from the adjacent airport. The plant is now turning out B-24s at a rate of one every working hour. All Ford aircraft contracts were on schedule, including Pratt & Whitney 2,000-hp. engines and turbo-superchargers, during May.

The Navy Dept. has cut back its orders for fighter planes because its rate of loss in combat operations has been only two-thirds of earlier estimates. This has resulted in termination of its contract with the Brewster Aeronautical Corp., effective July 1, for Corsair fighter planes. Brewster had a contract to produce 1,500 Corsairs at plants in Long Island City, N. Y., and Johnsville, Pa., of which about half will be completed by July 1. The Navy will concentrate its Corsair production at the Chance Vought Aircraft Division of United Aircraft Corp., Stratford, Conn., and the Goodyear Aircraft Corp., Akron.

In announcing its policy on the Brewster contract termination, the Navy said, "In view of the fact that the Brewster company is the smallest producer of Corsairs, has no additional Navy contract or prospects of any, and further because of its higher production costs than either of the two other companies in this particular production field, it was selected to bear the major impact of this curtailment in the Navy's aircraft program. In allocating cutbacks among the three manufacturers of Corsairs, the Navy decided against a proportionate reduction for the three companies because such a program would have meant that all three companies' production would have been disrupted, unit costs would rise and efficiency would fall. Also, consideration was given to the fact that United Aircraft was the designer and original producer of the Corsair, acted as engineering adviser to the other manufacturers of this plane, is developing several advanced and special performance versions of the Corsair and is conducting a number of experimental and development projects for the Navy. Goodyear, likewise, is developing new projects for the Navy and is a subcontractor for parts of other essential Army and Navy planes."

Chevrolet Motor Division of GM, which already has built more than

(*Turn to page* 59, *please*)

Cold-Drawn Tubing Heads List Of Hard-to-Get Steel Products

Demand Continues for Large Shell Rounds and Flat Rolled Steel. More Cadmium Now Available

By W. C. Hirsch

Aircraft grade, cold-drawn mechanical tubing heads the list of steel products of which purchasing agents find it difficult to obtain supplies. Some dimensions are almost impossible to get even when buyers express their willingness to wait until fall for deliveries. Pressure on mills' facilities for rolling large shell-rounds continue to tax capacity and little relief from this is looked for in the third quarter. Flat rolled steel mills are booked solid until October, with much tentative fourth quarter business already in sight. While strictly military third quarter needs are somewhat lighter than they were in the preceding quarter, not enough steel has been freed from possible claim by the armed forces to justify in the opinion of control authorities deviation from the policy of permitting none but the most essential civilian uses. The possibility of a seasonal dip in output because of high temperatures and loss in production because of manpower shortage are contingencies to be taken into consideration. Developments in the European theater of war have put the steel market in an expectant mood regarding their possible effect on W.P.B. reconversion policies. The supply of alloy steels has been augmented through the addition to NE steels of a number of new compositions, announcement of which was recently made by the American Iron & Steel Institute. All are designed to enlarge the utilization of alloy steel scrap. All the new NE alloys in the 9,700, 9,800 and 9,990 groups contain small quantities of chromium, nickel and molybdenum in varying proportions. Reinstated and enlarged has been the 8,700 group, which had to be suspended last fall because of a temporary shortage of molybdenum. According to the Institute, nearly one-third of the 1943 alloy steel consumption consisted of NE grades, many serving in automotive uses. One of the large independents

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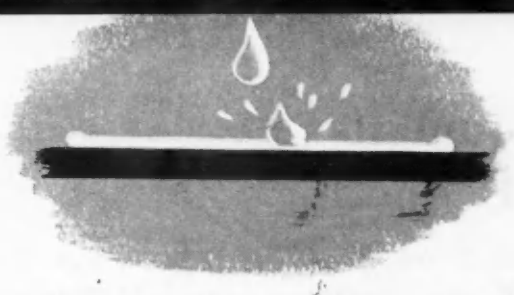
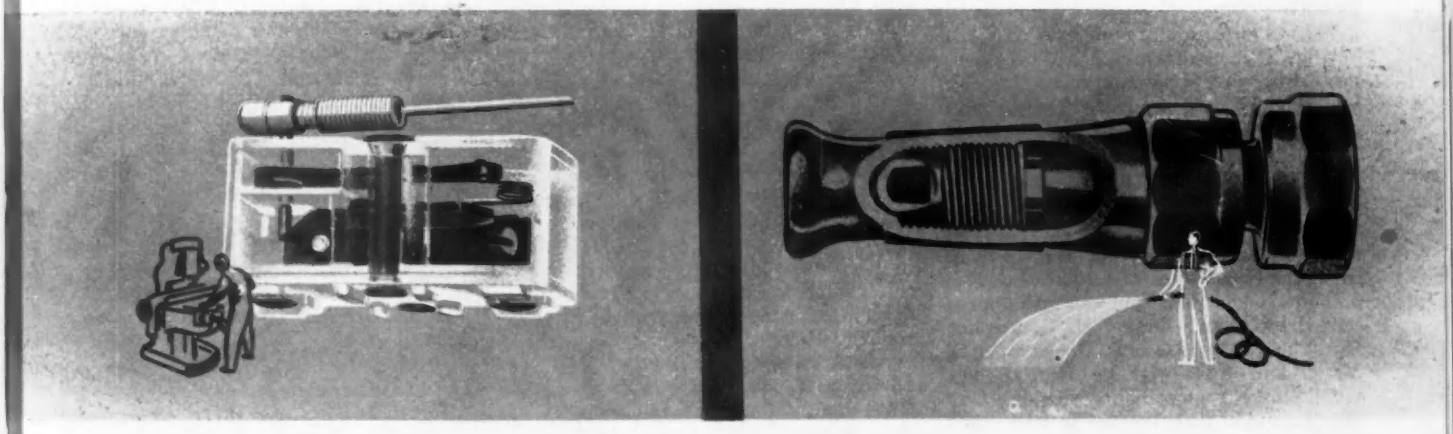


What plastic has highest resistance to water?

Among all plastics—Styron (Dow Polystyrene) stands out for stability to water. Absorption after 24 hours test is 0.00



Selection of plastic materials for a specific job usually calls for careful "balancing" of properties. After weighing all requirements, you will likely choose the one plastic that most nearly meets *all* of your needs.

In this process of selection, you will find Styron (Dow Polystyrene) an extremely helpful material. It is well balanced—capable of doing many jobs.

We call your attention to Styron's outstanding resistance to water because this single property is important in so many applications. In electrical products, precision moldings, and many movable parts, stability to water is essential. Styron's water absorption after 24 hours immersion at 25° C. is 0.00. Even after prolonged periods, it is not affected by humid conditions or contact with water—in moldability, color bleaching or dimensional stability.

Complete property "balance" is obtained through Styron's excellent insulating properties, low specific gravity, acid resistance and broad color range. These factors give Styron a place of importance in every plastic discussion.

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Write for the New Dow Booklet "A Practical Approach to Plastics."

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CHEMICALS PLASTICS MAGNESIUM

INDISPENSABLE TO INDUSTRY AND VICTORY

Wartime Developments Discussed at SAE Meeting

Theme Is—How Can the Automotive Industry Profit from the Engineering and Production Experiences of War?

An analysis of the program of the S.A.E. National War Materiel Meeting in Detroit, and contents of the technical papers, points to an important central theme—how can the automotive industry profit from the engineering and production experience of war? Naturally, much of the analogy is drawn from wartime aircraft developments. This follows from the extraordinary production volume of military airplanes, coupled with the unlimited budget which made possible the solution of many seemingly impossible production problems.

In this category are papers by V. C. Young, Mac Short and M. M. Holben. Similarly, the papers on materials by H. W. McQuaid and G. Vennerholm and E. C. Jeeter, touched on the developments in steels and ferrous castings which may be of great value in postwar metallurgy.

Average attendance ran close to 500 members and guests, and was swelled to around 600 for the banquet. The principal banquet address was presented by Rear Admiral H. G. Taylor, Bureau of Yards and Docks, U. S. Navy, and dealt with automotive materiel in Navy combat service. One entire session was devoted to still other aspects of wartime experience—on the subject of new chemical surface treatment for metals by W. M. Phillips, on the export packing of parts by C. E. Heussner and C. O. Durbin, and a report by H. T. Holbrook on the condition of such packaged materials as received overseas.

The production session covered the manufacture of the G.M. Diesel injector in the new Diesel Equipment Division at Grand Rapids in a paper by C. W. Truxell, Jr., who mentioned that to date over one million injectors for the Detroit Diesel Division Model 71 engine already had been produced. The other paper by M. M. Holben described some of the outstanding methods developed for the mass production of Wright engines.

Fittingly, the final session was on the topic of the day—the postwar car. W. B. Stout and Brooks Stevens both presented their views on this subject. Mr. Stevens attempted to bring down to earth some of the speculation that has been current in popular discussion in recent years. The postwar car, in his opinion, probably should be a moderately priced vehicle without individual fenders. He discounts the virtue of tear drop streamlining which, in his opinion, is not feasible anyway on the small car. Mr. Stevens also feels that the rear engine design, while possibly something to reckon with in the future, is not ripe for the postwar market. In fact, he offers counter arguments in favor of conventional design for many of the basic features usually claimed for the rear engined car. Touching on the application of the small lightweight aircooled engine, he feels it could be used in conventional designs to the same space advantages claimed for the location in the rear.

A simplified explanation of the design, functions and application of hydraulic transmissions for motor vehicles was presented in a comprehensive paper by Albert H. Deimel. The details of an improved design of a condenser type indicator for measuring static and dynamic pressures was presented in a paper by Grinstead, Frawley, Chapman and Schultz of G.M. Research.

Studebaker was well represented by its chief engineer, W. S. James, president of S.A.E.; N. N. Tilley, who discussed the problems involved in spark ignition fuel injection engines for motor vehicles, and R. P. French, who described some experiments in dust room testing.

W. S. James, president of SAE, reported at the annual banquet that the SAE had undertaken two marine engine research projects for the Navy, a study of torsional vibration and the effects of the chrome plating of cylinder liners.

Rear Admiral H. G. Taylor, superintending engineer of Area V, Bureau of Yards and Docks, was the principal banquet speaker and detailed the use of automotive materiel by the Navy's construction battalions or Seabees.

Sorensen to Head Willys-Overland

Charles E. Sorensen, former vice-president and general manager of the Ford Motor Company, has entered into a contract as chief executive officer of Willys-Overland Motors, Inc., and is to be elected president of the company, according to an announcement by Ward M. Canaday, chairman of the board.

Advertising Notes

Robert E. Tuttle, formerly vice president of MacFarland, Aveyard & Co., Chicago advertising agency, has been elected a vice president of Geyer, Cornell & Newell, Inc., and will serve as account executive on the Nash Motor Division account in Detroit.

Mr. C. O. Moosbrugger, advertising manager of consumer products, and Mr. G. S. Bond, advertising manager of industrial products, for Minnesota Mining & Manufacturing Company of St. Paul, announce the appointment of the Minneapolis office of Batten, Barton, Durstine & Osborn as advertising agency on all products.

Arthur L. Terry, former office and production manager for Brooke, Smith, French & Dorrance, Inc., Detroit has joined the New York staff of Arthur Kudner, Inc.

Wanted Some Practical Tailoring

Nothing is so galling to a people, not broken in from birth, as a paternal, or, in other words a meddling government, a government which tells them what to read, and say, and eat, and drink, and wear.

—Thomas B. Macaulay, British Statesman.

SEALED POWER LABORATORIES

Finest in the Industry Build Sealed Power Leadership

Continuing experiment with every make and type of engine, in the best-equipped laboratories to be found in the field, is responsible for Sealed Power's growing leadership. Major engine builders have been choosing Sealed Power products for more than 30 years.

Use the experience gained by our laboratories and engineers through all these years of leadership, to help make your good engines even better.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

BUY MORE WAR BONDS

SEALED POWER PISTON RINGS

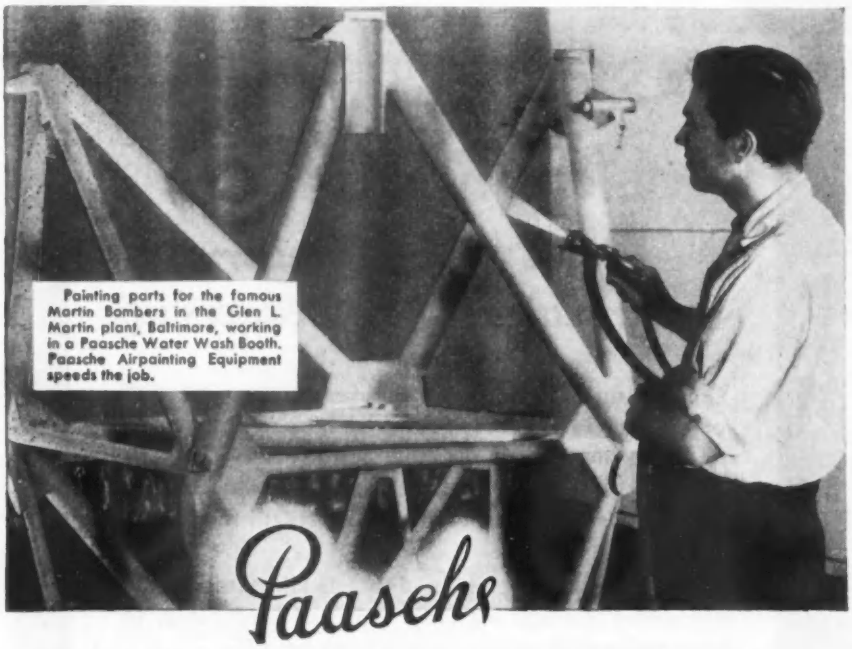
PISTONS — CYLINDER SLEEVES

Obituary

Arthur J. Brandt, 56, president and general manager of the National Tool Co. and president of A. J. Brandt, Inc., consulting engineers, died May 31 in Cleveland after a long illness. At one time he was vice president in charge of operations for Oakland Motor Car Co. and later assistant general manager of Hupp Motor Corp. He was a consultant to OPM on the government's small arms ammunition program in 1940 and served in the aircraft production division in 1941. He had been a consultant to Soviet Russia in the construction of truck plants and to the U. S. Rubber Co. and Austin Motor Car Co. of England. He was a director of Consolidated-Vultee Aircraft Corp. and a member of the SAE.

Francis A. McHale, 60, traffic manager of the Chevrolet-Flint Division of GM, died May 27 at his home near Flint after a short illness.

William H. Knight, 85, associated with the Buick Motor Division as a plant manager for 24 years, died May 30 at his home in Flint after a long illness. He has been connected with the automobile industry since 1903. He was associated with the Commercial Motor Car Co., Marion, N. J., and then from 1908 to 1932 has was with Buick.



Painting parts for the famous Martin Bombers in the Glen L. Martin plant, Baltimore, working in a Paasche Water Wash Booth. Paasche Airpainting Equipment speeds the job.

Paasche

WATER WASH BOOTHS

Conserve Paint • Add Production Hours • Reduce Fire Hazards • Promote Healthful Working Conditions

Paasche Water Wash Booths employ a constant curtain of water and the action of powerful sprays in a two-stage precipitation chamber, to wash down the overspray that otherwise accumulates on walls of booth, fans, piping, etc. Under proper conditions, the solids precipitated by this method can be reclaimed to make a substantial paint saving!

Further, Paasche Water Wash Booths eliminate time-wasting and hazards in spray-booth cleaning. They reduce fire danger to a minimum and are endorsed by safety engineers and industrial commissions. The clean, healthful working conditions they provide are an important factor in promoting favorable employee relations, and savings realized by the installation of Paasche Water Wash Booths quickly pay for the original investment.

Write for new Paasche Catalog. Gives full information on Water Wash Booths and other Manual and Automatic Airpainting Equipment. You'll want it for quick reference. **Address Paasche Airbrush Co., 1955 Diversey Parkway, Chicago 14, Illinois.**

Paasche Airbrush (Canada), Ltd., 110 Elm Street, Toronto, Ontario.

Paasche AIRPAINTING EQUIPMENT

Manual, automatic and special airpainting equipment, airfinishing booths, pressure regulators, airconditioners for compressed air lines, air dusters and stripers.

ARMY E NAVY

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the June 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press:

AIR REDUCTION CO., INC., Ohio Chemical & Mfg. Co., Heidbrink Division, Minneapolis, Minn.
ASSOCIATED SPRING CORP., The Wallace Barnes Co., Rolling Mill Division, Forestville, Conn.
FORD MOTOR COMPANY, Ford Glider Plant, Iron Mountain, Mich.
GENERAL MOTORS CORP., Detroit Transmission Division, Detroit, Mich.
HERCULES POWDER CO., Badger Ordnance Works, Baraboo, Wis.
INTERNATIONAL HARVESTER CO., Wisconsin Steel Works, Chicago, Ill.
UNITED STATES RUBBER CO., Bristol Plant, Bristol, R. I.
UNITED STATES RUBBER CO., Stark Mills, Hogansville, Ga.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

KIEKHAFER CORPORATION, Cedarburg, Wis.
WIREMOLD COMPANY, Hartford, Conn.

American Chain & Cable Co. Acquires Wilson Inst. Co.

Wilson Mechanical Instrument Company, Inc., New York, N. Y., the sole maker of the "Rockwell" Hardness Tester, was recently acquired by American Chain & Cable Company, Inc., Bridgeport, Connecticut. Mr. Charles H. Wilson will continue to be actively associated with the company.

CALENDAR

Conventions and Meetings

American Society for Testing Materials (47th Annual Meeting), New York City — June 26-30

SAE Natl. Transportation & Maintenance Meeting, Philadelphia — June 28-29

SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, Oregon — August 24-25

SAE Natl. Tractor Meeting, Milwaukee — Sept. 13-15

SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles — Oct. 5-7

SAE Natl. Fuels & Lubricants Mtg., Tulsa — Nov. 9-10

American Chemical Society Natl. Chemical Exp., Chicago.....Nov. 15-19

SAE Natl. Air Cargo Mtg., Chicago, Dec. 4-6

SAE Annual Meeting, Detroit — Jan. 8-12

GOOD NEWS!

Better light-gauge metal welding...

WITH THE IMPROVED

WILSON No. 520-A ELECTRODE

Made in 1/16", 5/64" and 3/32" sizes

IT'S especially designed for AC or DC welding of light gauge chrome-moly and similar steels used in aircraft construction. Made to a completely new formula, the Wilson No. 520-A Shielded Arc Electrode provides these four notable improvements:

1. Better appearance of deposit
2. Stronger arc action
3. Reduced arc interference
4. Ability to work at higher currents without deterioration of coating at stub end.

And that's not all! This electrode is available in all three popular aircraft welding sizes—1/16", 5/64", and 3/32" diameters, 9", 12" and 12" lengths respectively. It is used with AC and is also satisfactory for DC operation, straight or reversed polarity.

Test specimens welded with Wilson No. 520-A show tensile strengths of 80,000 to 90,000 psi. It meets the requirements of U. S. Army Air Corps Specification 10286B, and conforms to A.W.S. and A.S.T.M. Specifications for Classification E 6013.

For complete details on the Wilson No. 520-A call or write any authorized Wilson distributor. Or mail the coupon for prices and data on Wilson's complete line of AC and DC electrodes.

AA

MAIL COUPON FOR FULL DETAILS

WILSON WELDER & METALS CO., Inc.
60 East 42nd St., New York 17, N. Y.

Please forward by return mail copies of

☐ Wilson Electrode Price List
☐ Electrode Consumption Calculator

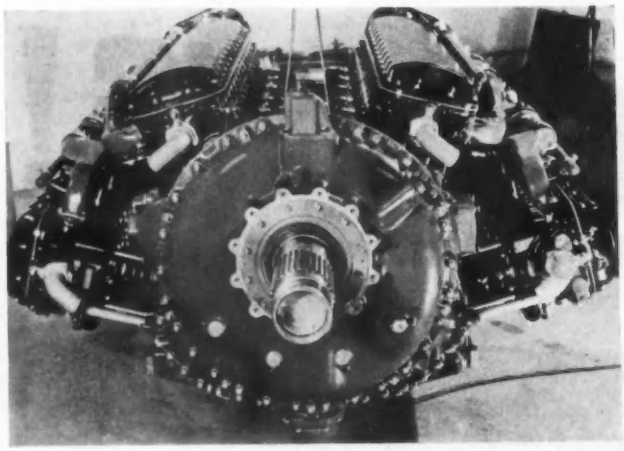
NAME.....
COMPANY.....
ADDRESS.....
CITY.....STATE.....

WILSON

WILSON WELDER and METALS CO., INC.

General Offices: 60 East 42nd Street, New York 17, N. Y.

Authorized Distributors in Principal Cities



This is the V-3420 series, 24-cylinder, liquid cooled Allison aircraft engine. It is said to develop approximately 3,000 hp and to weigh less than one pound per horsepower. Many of the parts are interchangeable with those of the present standard 12-cylinder Allison engine.

NITE HAWK

AERO-STARTER

PORTABLE, ENGINE DRIVEN POWER PLANT

REDUCES TAKE-OFF TIME:

Provides ample cranking power for starting big bombers, cargo and fighter planes. Eliminates delays due to discharged storage batteries. May be operated continuously at any temperature and under all climatic conditions.

FURNISHES POWER

. . . for testing landing gear and auxiliary apparatus, checking circuits and wiring, turrets, etc.

GIVES YOU LIGHT FOR NIGHT OPERATIONS

. . . for refueling, checking adjustments, hangar lighting, emergency field lighting, emergency field repair, rescue and salvage work.

AIR COMPRESSOR ATTACHMENT AVAILABLE!

Write for Bulletin No. NH12A

NITE HAWK

Lister-Blackstone

INCORPORATED 1706 SO. 68TH ST., MILWAUKEE 14, WIS.

MFRS. OF PORTABLE NITE-HAWK AERO-STARTERS, SEARCHLIGHT AND FLOODLIGHT UNITS

ALSO DIESEL ENGINES AND DIESEL-ELECTRIC POWER PLANTS

Business in Brief

***Written by the Guaranty Trust Co. New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

General business activity remains approximately stable. The seasonally adjusted index of *The New York Times* for the week ended May 20 stood at 144.8, as compared with 144.6 for the preceding week and 141.1 a year ago.

Department store sales, as reported by the Federal Reserve Board, declined from 158 to 151 per cent of the 1935-39 average in the week ended May 27; and the value shown was 11 per cent above the corresponding figure in 1943. For 1944 to date, the total is 7 per cent greater than the comparable sum last year.

Railway freight loadings during the week ended May 20 totaled 871,105 cars 0.3 per cent more than the preceding weekly number and 3.2 per cent above the corresponding figure in 1943.

Production of electric power increased contra-seasonally during the week ended May 27; and the total was 7.6 per cent above the output a year ago, as against a similar excess of 6.3 per cent reported a week earlier.

Crude oil production in the same period averaged 4,514,050 barrels daily, 650 barrels above the figure for the preceding week but 5650 barrels less than the average output recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended May 20 was 12,300,000 net tons, 2.1 per cent less than the preceding weekly figure, as compared with 11,429,000 tons in the corresponding period last year. For 1944 to date, output is 5 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended May 25 totaled $27,885,000, as against $26,907,000 for the week before, according to *Engineering News-Record*. Contracts so far reported in 1944 show a decline of 51 per cent from the corresponding amount in 1943—private projects registering an advance of 13 per cent, while public construction has dropped 58 per cent.

The Irving Fisher index of wholesale commodity prices stood on May 26 at 112.9 per cent of the 1926 average, one fractional point below the peak recorded a week earlier.

Member bank reserves increased $46,000,000 during the week ended May 31, but excess reserves declined $100,000,000 to an estimated total of $700,000,000. Business loans of reporting members declined $84,000,000 in the preceding week but stood $199,000,000 above the total a year earlier.

PUBLICATIONS

Equitable Bearing Co., Inc., has issued a four-page illustrated folder describing and illustrating **precision bearings.** The folder contains a short history of the company and its personnel.

Contract Service is the title of an interesting booklet issued by L. F. Grammes & Sons, Inc. The booklet tells of the contract service facilities provided by the company and includes descriptions and illustrations of its etched metal products.•

H. P. Preis Engraving Machine Co. has issued a new folder on its **Panto Utility**

★ PROVING GROUNDS

From ocean depths to stratosphere heights — in submarines, destroyers, escort and landing craft, tanks, trucks, jeeps and 80 types of Allied war planes — American Hammered Piston Rings are proving their absolute *correctness* for every purpose. Koppers Company, American Hammered Piston Ring Division, Baltimore, Md.

WAR PLANES USING AMERICAN HAMMERED PISTON RINGS

A-20 Havoc
A-22 Maryland
A-24 Dauntless
A-25 Shrike
A-29 Hudson
A-30 Baltimore
A-31 Vengeance
A-34 Buccaneer
A-36 Invader
B-17 Flying Fortress
B-18 Bolo
B-23 Dragon
B-24 Liberator
B-25 Mitchell
B-26 Marauder
B-29 Superfortress
B-34 Ventura
C-43 Traveler
C-45A Voyager
C-46 Commando
C-47 Skytrain
C-53 Skytrooper
C-54 Skymaster
C-56 Lodestar
C-61 Forwarder
C-69 Constellation
C-76 Caravan
C-87 Liberator Express
J-4-F Widgeon
L-1 Vigilant
L-2 Hedgehopper
L-3 Grasshopper
L-4 Grasshopper
L-5 Sentinel
O-52 Owl
P-40F War Hawk
P-43 Lancer
P-47 Thunderbolt
P-51B Mustang
P-61 Black Widow
P-66 Vanguard
AT-6 Texan
AT-7 Navigator
AT-8 Bobcat
AT-9 Jeep
AT-10 Wichita
AT-11 Kansas
AT-13 Yankee Doodle
AT-14 Yankee Doodle
AT-15 Crewmaker
AT-17 Bobcat
AT-19 Reliant
BT-13 Valiant
BT-15 Valiant
PT-13 Caydet
PT-17 Caydet
PT-19 Cornell
PT-22 Recruit
PT-26 Cornell
F2A Buffalo
F4F Wildcat
F4U Corsair
F6F Hellcat
N2T Tutor
OS2U Kingfisher
PBM Mariner
PBY Catalina
PB2Y Coronado
SB2A Bermuda
SB2C Helldiver
SB2U Vindicator
SBD-3 Dauntless
SO3C Seagull
SNC Falcon
SNJ Texan
TBD Devastator
TBF Avenger
JRM-1 Mars
YO-51 Dragonfly
Sikorsky Helicopter

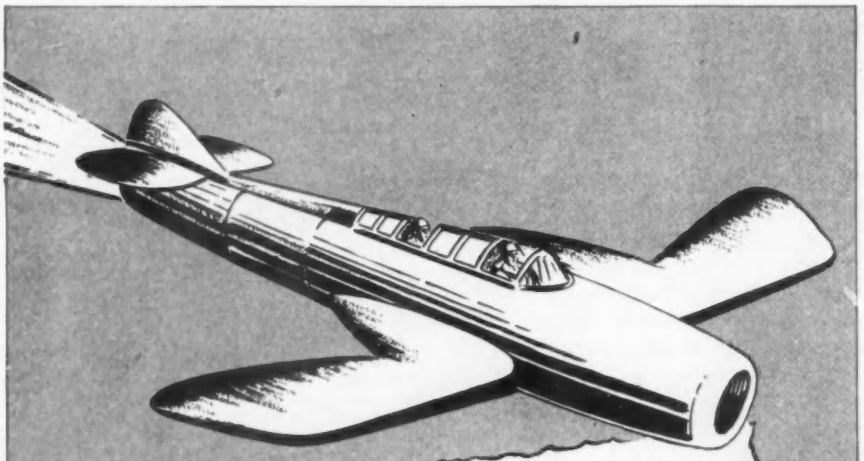
SUBMARINE SINKS AXIS SUPPLIES

American Hammered Piston Rings

A KOPPERS PRODUCT

ARMY NAVY

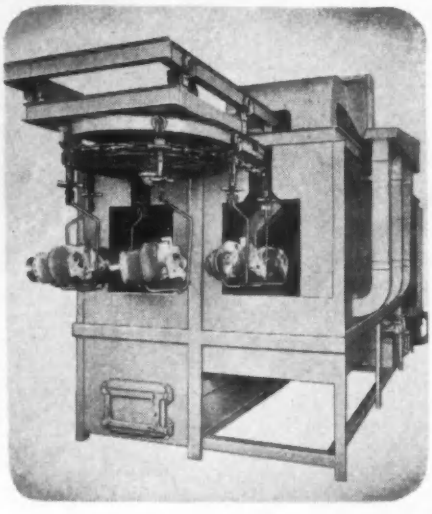
The only Army-Navy "E" awarded for Piston Ring Production



" Jet Propelled ! can you design equipment to clean the engine ? "

WHEN "J-P" planes are produced in quantity we have no doubt we will be asked to design equipment to "thoro-clean," rinse and dry the jet propulsion engines—just as we have been requested to engineer and produce equipment to thoro-clean and finish every other type of metal part and product for quality control.

Specialists in the application of both metal products cleaning and finishing and endless-stream conveyor systems, A-F Engineers will help your plant, too, synchronize the cleaning, finishing and "indoor transportation" of your metal parts and products. Write today, without obligation on your part, for latest illustrated folders or a discussion of your problems with an A-F Engineer.



Many manufacturers of conventional type engines are now securing "quality control" with A-F Cleaning and Finishing Equipment.

ARMY E NAVY

THE ALVEY-FERGUSON CO.

24 Disney St. Cincinnati 9, Ohio

Branch Offices in Principal Cities

Affiliated Corporation: The Alvey-Ferguson Co. of California P.O. Box 396, Vernon Branch, Los Angeles 11, Calif.

CONVEYING EQUIPMENT

CONVEYING A-F MACHINERY

Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

Engraver, Model UE-3, for engraving, electrical marking and acid etching.*

Barber-Colman Company has published a new booklet describing and illustrating its **Barcol Overdoors** and electric operating equipment for doors, gates, etc. Diagrams of the various models, together with specifications, are included in the booklet.*

The March-April issue of **The Bearing Engineer,** published by the Torrington Co., contains an interesting article, High Capacity Ball Reciprocating Bearings, and one on Needle Bearings in King-Seeley Governors.*

Air Reduction is offering a pocket-sized, **slide-type guide** that shows proper tip sizes, gas pressures and other data required for machine gas-cutting steel of various thicknesses, with two of Airco's gas-cutting tips —Airco 45 and 125.*

Engineering data and description of the Metro line of **precision gages and carbide tipped tools** is contained in a new catalog, No. 102, issued by Metro Tool & Gage Co. Also included are detailed descriptions of carbide tipped cutting tools, centers and masonry drills.*

Impact Die Forging, commercially known as Drop Forging, is the title of a new book published by the Chambersburg Engineering Co. Devoted to basic information on that subject, it is intended primarily for use as a textbook in engineering schools. It contains a number of tables of important engineering data on drop forging.*

Pratt & Whitney has issued a new folder on its **ANPT Pipe Thread Gages.** The folder is illustrated and contains descriptions of the gages, what they do and how to use them.*

Complete description and specifications on P&H's recently announced low-cost model **WP-2 welding positioner** are given in a bulletin released by Harnischfeger Corp., Welder Div. A comparison chart is included showing how welding time efficiency is increased when work is positioned to the best advantage.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

PERSONALS

G. W. Cannon, formerly vice-president, has been elected president of Campbell, Wyant & Cannon Foundry Co., succeeding the late D. J. Campbell. **I. A. Wyant,** formerly treasurer, was elected vice-president. **W. R. Hummel** was named treasurer and **R. L. Lindland** secretary.

H. Lynn Pierson, president of Detroit Harvester Co., has been appointed chief of the Cleveland Ordnance District, succeeding Col. H. M. Reedall, who has been transferred to the staff of Lieut.-Gen. B. H. Somervell.

William S. James, chief engineer of Studebaker Corp. and president of the SAE, has been presented with the George Washington University alumni award for **achievement in science and service to the university.**

Charles R. Morrison, former vice-president of International Harvester Co., has been appointed to the price adjustment section board of the Chicago Ordnance District.

Carl Eschedor has been appointed factory employment manager of Willys-Overland Motors, Inc., with **Edwin J. Otte** named his assistant.

Fred M. Zeder, vice-president and vice-chairman of the board of Chrysler Corp., has been awarded the honorary degree of doctor of laws by University of Detroit.

Maurice N. Trainer, first vice-president, has been elected a director of American Brake Shoe Co. **Robert H. Ramage** has been named advertising manager for the headquarters division in New York.

(*Turn to page 59, please*)

IT STOOD THE GAFF IN TAXICABS!—

● Before the war, Formica stood its apprenticeship as an interior finish for motor cars in the product of leading taxi-cab manufacturers, who needed something that would be good looking and stay that way in cars whose interior equipment takes a terrific beating.

Formica surfaces for the interiors of doors, and for the back of front seats, and fronts of back seats, stood the severe service. It was sanitary, easy to clean and attractive. More than one large taxi-cab user had begun to equip his old cabs with the sheet before it became unavailable. For Formica had make good in a big way with both the manufacturer and the user.

These same advantages will be ready and at moderate cost, by simple, easy, production processes, for private passenger cars after the war. And it is sure to count heavily as a sales point.

"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it used. Available for meetings of designers and business groups.

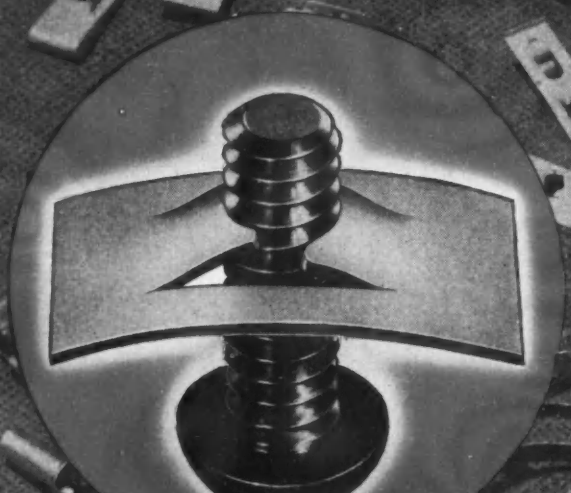
FORMICA

ARMY E NAVY

THE FORMICA INSULATION COMPANY 4612 SPRING GROVE AVENUE, CINCINNATI 32, OHIO

Over 2000 Assembly Short Cuts

with Speed Nuts



The SPEED NUT System of spring-tension fasteners comprises more than 2000 shapes and sizes. Back of each and every design was a new reason, hence a new method to improve specific assembly jobs.

In some cases, certain parts are completely eliminated. In other cases riveting operations or drilling of holes is dispensed with. Many SPEED NUTS hold themselves in screw-receiving position. Dismantling of parts for service or repair is often made twice as easy. And in every case, weight is reduced from 50% to 70%, time is generally cut in half and net assembly costs hit a new low.

Hundreds of metal, wood, and plastic products have already been fastened better in over 2000 ways with SPEED NUTS. Use more of them to fullest advantage now. If in doubt on correct shape, send blueprints for quick help.

TINNERMAN PRODUCTS, INC.

2059 FULTON ROAD • CLEVELAND 13, OHIO

*Trademark Reg. U. S. Patent Office

Fastest Thing in Fastenings

Personals

(*Continued from page* 56)

Ernest G. Liebold, one-time personal secretary to Henry Ford and associated with the Ford Motor Co. since 1910, has severed his connections with the company.

The promotion of **Leroy Camel,** Cleveland, to sales manager of the Alkali Div., has been announced by Detrex Corp. Mr. Camel was previously manager of the Eastern section of the Alkali Div. with offices in Cleveland.

Purolator Products, Inc., has announced the appointment of **Carl B. Schnippel** as assistant sales manager with jurisdiction over after-market sales in the Pacific Coast and Intermountain States.

A. N. Guy has been appointed manager of the automobile tire dept. of Fisk Div., United States Rubber Co. **Howard E. Malcomb** has been appointed to take charge of farm and heavy service tire activities for Fisk Div., United States Rubber Co..

Union Carbide and Carbon Corp. has announced the election of the following presidents of its subsidiary companies: **Dr. Joseph G. Davidson,** president, Carbide and Carbon Chemicals Corp. and Carbide and Carbon Chemicals, Ltd.; **James W. McLaughlin,** president, Bakelite Corp.; **Stanley B. Kirk,** president, The Linde Air Products Co., The Prest-O-Lite Co., Inc., and Dominion Oxygen Co., Ltd., and Prest-O-Lite Co. of Canada, Ltd.; **Arthur V. Wilker,** president, National Carbon Co., Inc., and Canadian National Carbon Co., Ltd.; **Francis P. Gormely** president, Electro Metallurgical Co., Electro Metallurgical Co. of Canada, Ltd., Haynes Stellite Co., Michigan Northern Power Co. and Union Carbide Co. of Canada, Ltd.; **John D. Swain,** president, Electro Metallurgical Sales Corp., and **John H. Van Fleet,** president, United States Vanadium Corp.

William G. Hancock, general sales manager of McCord Radiator and Mfg. Co., has been elected to the board of directors of the Automotive Council for War Production.

Boots Aircraft Nut Corp. and the Fibre Lock-Nut Corp. have announced the appointment of **J. Nelson Kelly** as executive vice-president of the Fibre Lock-Nut Corp.

Clinton E. Swift has been made assistant manager of the engineering and research dept. of Eutetic Welding Alloys Co.

Bendix-Westinghouse Air Brake Co. has announced the following appointments: **I. F. Nelis,** manager, Government sales; **E. W. McKay,** Eastern regional sales manager; **A. E. Wolfe,** Western regional sales manager; **D. R. Brehm,** Southwestern regional sales manager; **J. F. Shumaker,** Eastern regional engineer; **J. V. Ralston,** Central regional engineer; **W. L. Bevan,** Western field engineer; **J. Simmons,** Southwestern service representative, and **G. E. Gribble,** Central service representative.

Frank W. Bemis has been made sales manager of the American Cable and Hazard Wire Rope Divisions of American Chain & Cable Co., Inc., with headquarters in New York City.

Carl F. Baker has been appointed chief engineer of Hamilton Standard Propellers Div. of United Aircraft Corp.

Allison Producing 3000 HP Engine

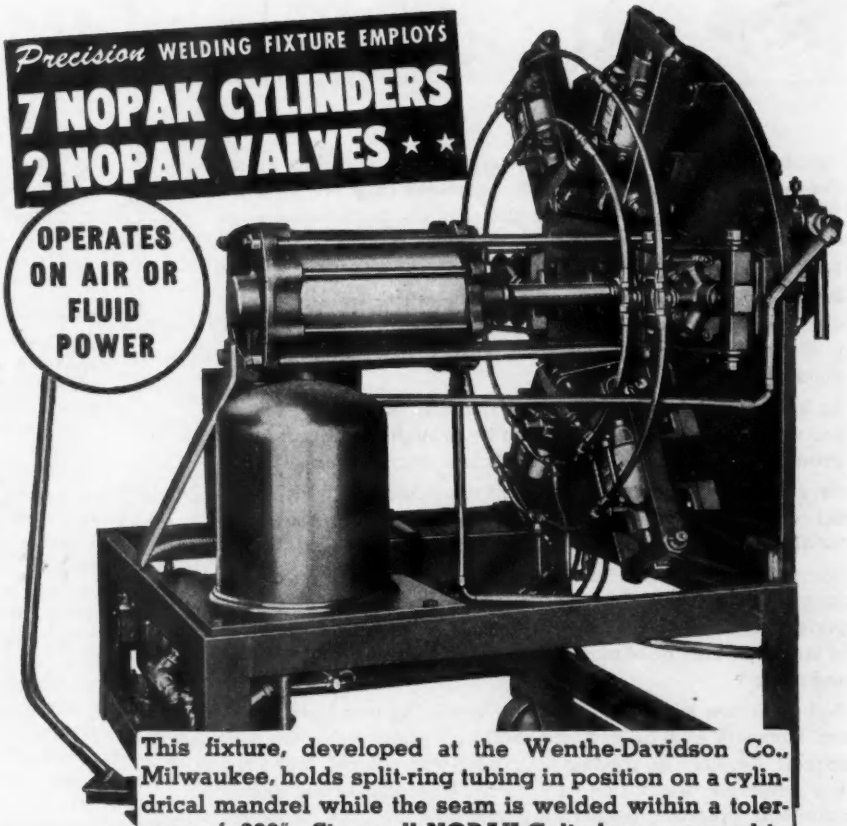
(*Continued from page* 48)

39,000 Pratt & Whitney Twin Wasp 14-cyl. aircraft engines, has begun construction of a new addition to Aviation Engine Plant No. 1 at Tonawanda, N. Y. The addition, 317 by 360 ft. and containing 114,120 sq. ft., will provide extra manufacturing space to house assembly lines for production of the P. & W. 18-cyl. R-2800-C version of the Double Wasp engine. Forty-six of the plant's 90 test cells will be utilized for testing the new engines. Chevrolet will continue production of the Twin Wasp engine concurrently with the new type.

The U. S. has turned out 171,257 war planes since Pearl Harbor, according to a joint report by WPB and the Aircraft Production Board. The U. S. and British Empire together have produced 300,000 planes since the start of World War I, while Germany and Japan are estimated to have produced 151,000 planes in the same period.

GMC Truck & Coach Division of GM is the largest producer of Army trucks, having built more than 400,000 of all types. This division recently turned out its 350,000th 2½-ton 6x6 truck for the Army. It also is the largest supplier of amphibian trucks (ducks) for the Army and builds 4x4 trucks and some specialized vehicles. Studebaker Corp., also a large supplier of 2½-ton 6x6 trucks, has passed the 124,000 mark in the output of military trucks. Studebaker also has manufactured more than 40,000 Wright Cyclone aircraft engines, several thousand more than enough to power all the Flying Fortresses built since Pearl Harbor.

Precision WELDING FIXTURE EMPLOYS
7 NOPAK CYLINDERS
2 NOPAK VALVES ★★
OPERATES ON AIR OR FLUID POWER



This fixture, developed at the Wenthe-Davidson Co., Milwaukee, holds split-ring tubing in position on a cylindrical mandrel while the seam is welded within a tolerance of .003". Six small NOPAK Cylinders, arranged in a circle, actuate lever-clamps which apply equal pressure over the exterior surface of the tubing. The large cylinder operates push rods which eject the finished tube from the mandrel.

One NOPAK 4-Way Valve controls the 6 small cylinders; another controls the large ejector cylinder. This fixture is designed to operate on air or fluid power, at will. A self-contained electrically driven unit quickly generates hydraulic power if air is not available.

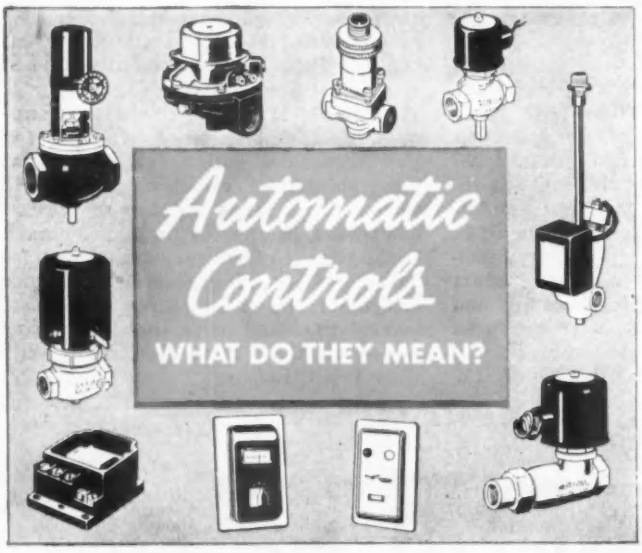
For further particulars on this unique example of skillful tool engineering, write for illustrated bulletin.

GALLAND-HENNING MFG. CO., 2774 S. 31st St., Milwaukee 7, Wis.

Representatives in Principal Cities

NOPAK VALVES and CYLINDERS
DESIGNED for AIR or HYDRAULIC SERVICE

A 4418-½I



Automatic controls of pressure, temperature and flow assure *pre-determined accuracy of results* wherever they are used. No thinking executive, production manager or maintenance engineer can miss the full significance of this statement.

In factories and plants of every size and kind, *automatic controls* increase productive output and reduce waste by simplifying operations, speeding work, and assuring uniformity of finished product. With controls, even the most inexperienced novices quickly attain proficiency.

In homes and buildings, large and small, *automatic controls* promote economy, comfort, health by providing optimum temperature and humidity, saving fuels and doctors' fees.

On stationary equipment such as presses, machine tools, internal combustion and diesel engines, *automatic controls* save materials, plumbing, space, time and money.

On moving equipment such as aircraft, ships, tractors, trucks. tanks, locomotives, **hi-g** *light-weight controls* assure efficient performance because they operate in any position, regardless of vibration, change of motion or acceleration. **hi-g** saves weight and space.

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SAE Chicago Meeting

(*Continued from page* 31)

of carbon black, iron oxide and asphaltenes. The amount of iron oxide present at the end of 200 hours is the criterion of filter performance.

Other auxiliary tests devised to insure against filter failure in service included—a shock test to see if the filter will withstand a sudden jar or excessive vibration; a water immersion test to observe the action of water or

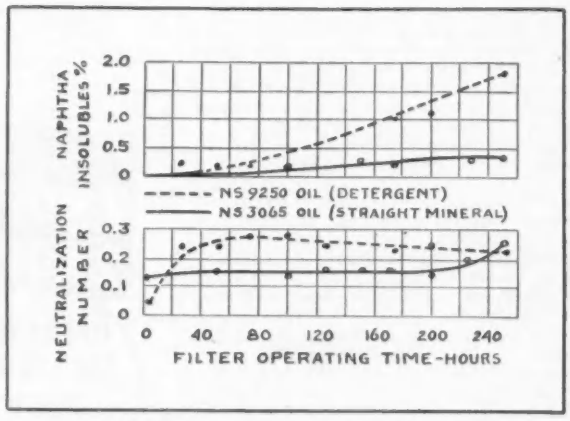

Fig. 4—Filter performance with straight mineral and heavy duty (detergent type) diesel lubricating oils, engine, 90 HP—oil temp., 200 F—filter size 968 cu. in., pressure drop across filter, 20 PSI.

moisture (as in marine service) on filter performance; and, tests to determine filter element breakdown, if any, and subsequent contamination of the filtered oil with foreign material.

Some of the most important conclusions reached regarding filtration of lubricating oils are as follows:

The dissolving effect of detergents added to oils renders impractical the removal of carbonaceous material by means of filters now commercially available. Harmful, abrasive material may be defined as consisting of all abrasive particles having their greatest dimension equal to, or greater than, 0.0002 inches; the highest, practical flow rate will keep the abrasive content at the lowest, possible concentration; high flow rates can be maintained by "shunt" operation of several filter units, by high oil temperature and by high pressure drop across the filter element; rapid warm-up of the filter is important with intermittent engine service; and high fuel consumption often coincides with high carbon content in the lubricating oil as much of this carbon results from incomplete combustion of the fuel.

Supercharging Diesel Engines

By E. W. Wasielewski, Chief Engineer,
McCulloch Engineering Corp.

THE application of a supercharger to a Diesel engine requires careful consideration of the design of the engine; hit-and-miss application might result in excessive thermal and mechanical stresses which the engine is not equipped to withstand. Very close attention must be given to head cooling, design of injection nozzles, valve timing, choice of compression ratio, the possibilities of charge cooling (air charge from the supercharger), and the heat-stressing of piston rings and valves.

Once a supercharger has been properly applied to a given engine, definite benefits, both direct and indirect can be realized. In addition to the increased power ob-

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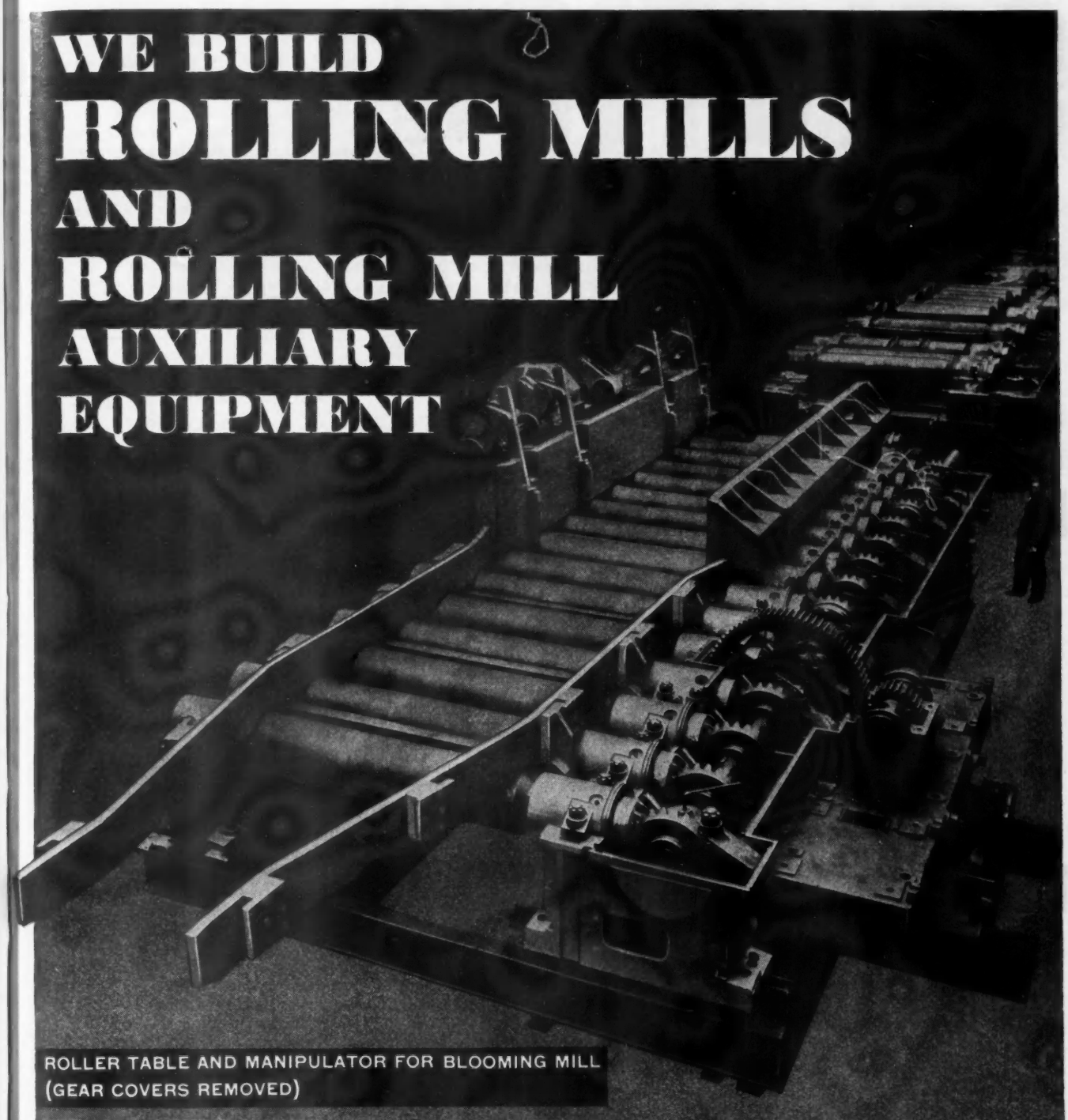

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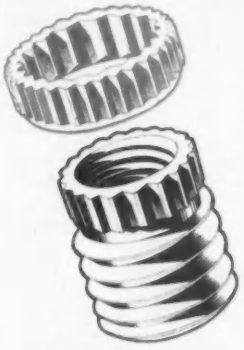

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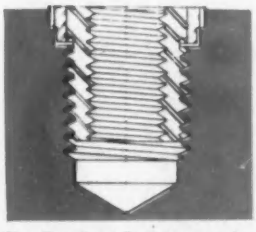
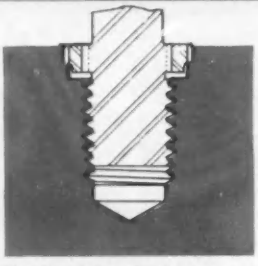
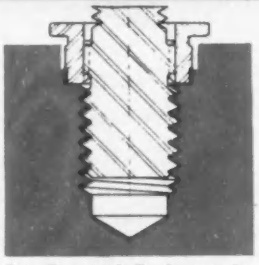
ROSÁN LOCKING SYSTEM

U. S. and Foreign Pats. Pend.

STANDARD INSERT	STANDARD STUD	TERMINAL STUD
		
The Standard Insert owes its permanence of installation to the Rosán Locking Ring. This ring broaches the parent material with the sharp leading edges of its outer serrations or splines.	The Locked-in Stud owes its permanence of installation to a locking ring identical with that used on our threaded inserts. Any amount of torque may be applied without disturbing this stud.	The Terminal Stud may be put in from the front; requires no through-boring, recessing or shielding at the back. It is easily removable without disturbing the panel.

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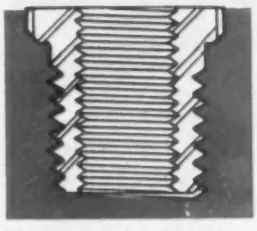	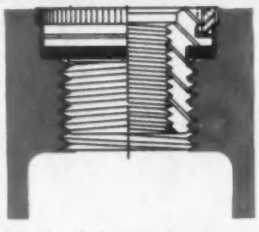	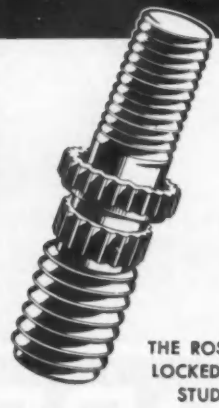
The Replaceable Molded-in Insert is used for plastics and other molded materials. Removal leaves a threaded, counterbored and serrated hole into which our Standard Insert may be installed.	On the Hydraulic Seal Insert, straight external threads are sealed with an AN #902 synthetic rubber ring. Internal threads with a standard "AND" type seal tested up to 10,000 lbs. per square inch.	THE ROSÁN LOCKED-IN STUD

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tained by virtue of the increased density of the air charge, there are secondary power gains resulting from the scavenging-effect (obtained by valve overlap), and from the cooling of the combustion chamber and the piston. However, the latter uses of supercharged air can be overdone resulting in an actual loss of power.

Another secondary effect of supercharging is the change in the fuel ignition-lag. With a boost pressure of 26 in. of mercury, the ignition lag is reduced more than 11 per cent. This is a definite aid in adapting the fuel injection cycle to the new, supercharged

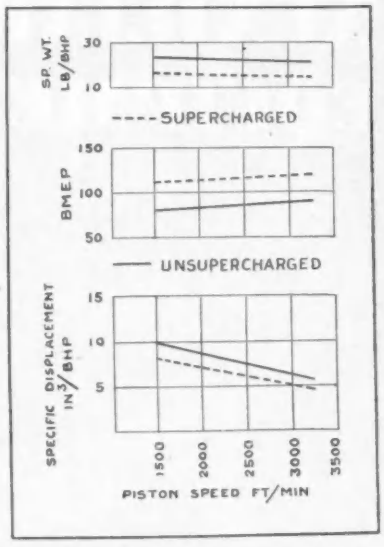

Fig. 5—Average performance of present day diesel engines.

conditions, especially when the size of the engine is simultaneously reduced.

Among the benefits to be obtained from supercharging are increased bmep, and decreased engine weight and size. The average performance in these respects of a large number of present-day engines, is shown in Fig. 5. This does not, however, represent the best performance obtainable. The best value for specific weight is about 11 lb per bhp in an unsupercharged engine and 9 lb in a supercharged one. The highest values of bmep encountered are about 110, unsupercharged, and 135, supercharged. Similar figures for displacement are 4 cu in. per bhp versus 3 cu in., respectively.

Development of Heavy Duty Oils for Military Vehicles

By **Capt. W. B. Bassett**, Technical Div., Office, Chief of Ordnance

EARLY in 1941 there were no standard lubricants for U. S. Army vehicles. Action was taken to adopt straight mineral oil, Navy symbol lubricants for gasoline engines, and special additive type oils, developed in Caterpillar and General Motors tests, for Diesel engines. As military operations progressed, it was found that the uninhibited, straight mineral oils caused

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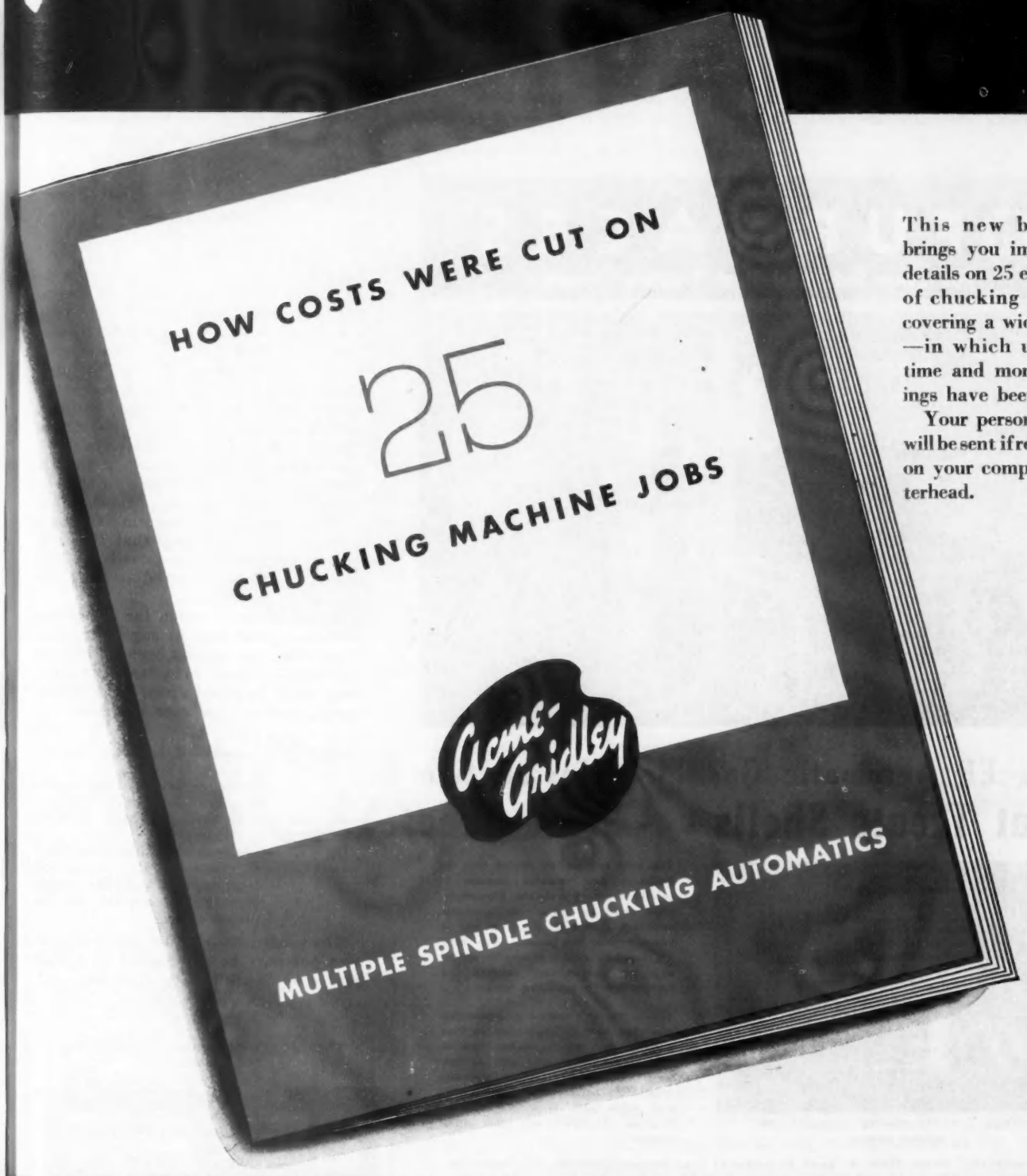

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corrosion in alloy bearings. Consequently, U. S. Army Specification 2-104, previously adopted for Diesel engines, was specified for all engines since it had been found able to control corrosion and objectionable deposits in the severer Diesel service.

As the supply of the necessary additive materials and base stocks for "2-104" became critical, and short at times, steps were taken to provide a permanent, approval basis for future motor oil supply for Army use. Under this new plan, the Ordnance Dept. advises the refiner what engine tests are required for qualification, and the test parts and data are subsequently submitted to a reviewing committee composed of representatives of the Caterpillar Tractor Co., General Motors Corp., Armour Research Foundation and the Ordnance Dept. This committee then makes recommendations to the Ordnance Dept. as to whether the particular oil meets the accepted standards for the specified engine tests, which are the same as those previously used by Caterpillar and General Motors in their respective programs and the procedures have been published by the Coordinating Research Council under designations L-1 through L-5.

In addition to the above stability tests there are other specifications, only two of which can be discussed at this time. They are, pour test and foaming tendencies. The pour point is determined by the usual ASTM method. Foaming is investigated by bubbling clean, dry air through the oil and measuring the amount of foam developed in specified time intervals. All oils of SAE 30 and 50 must now be foam-inhibited. Where a sufficiently low pour point cannot be attained for arctic operations, gasoline or low pour point Diesel fuel is used as a diluent. Up to 30 per cent dilution has been recorded with no ill-effects to engine parts. The use of heavy duty oils of the additive type has been reflected in increased engine life and longer periods between overhauls.

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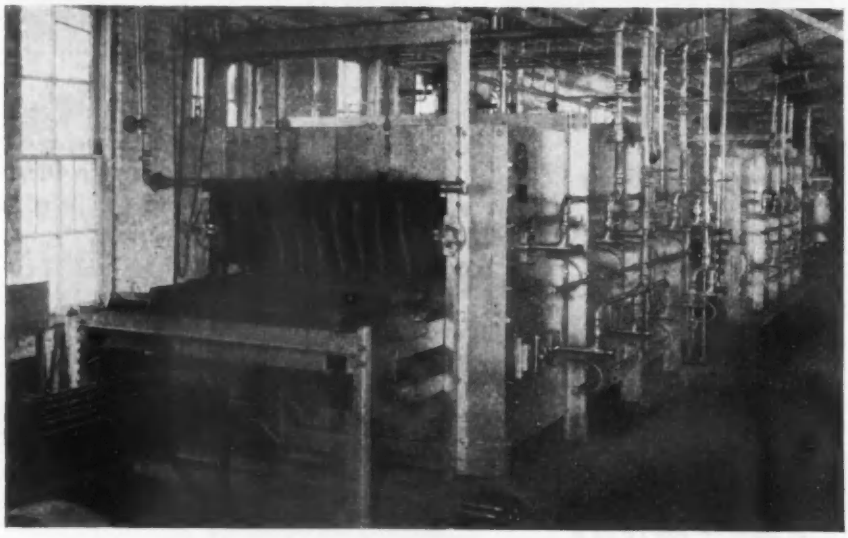

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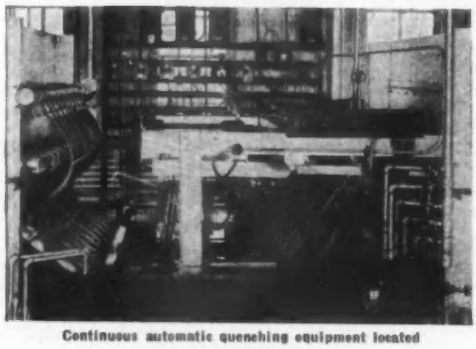

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An Analysis of the Heat Flow Into Pistons

By Carl H. Paul

Research Dept., Caterpillar Tractor Co.

THERE are two primary means by which heat flows from the engine cylinder gases; first, by radiation from the luminous flame, and second, by convection. Very few measurements of radiation have been made and the calculations have been based on assumed gas temperatures. From what little is known of radiation, it can be said that the radiant energy emitted is a function of the partial pressure of the gas and is directly proportional to the distance that the heat wave must travel before being absorbed in the gas volume. It is indicated that the total amount of heat transferred by this means is small compared to that dissipated by convection.

Since instrumentation for measuring convective heat flow in engine combustion spaces has not yet been sufficiently developed, general heat transfer equations must be relied upon. The fundamental equation for such convection is:

$$q = hA\ (t_g - t_s)$$

where q = amount of heat transferred, btu/hr.
h = mean coefficient of convective heat transfer, btu/hr-ft²-F.
A = area through which the heat is flowing, ft.²
$(t_g - t_s)$ = temperature difference, Deg. F., between the mean gas temperature and the mean surface temperature of the piston crown.

The coefficient h is not easily evaluated but may be determined to a fair degree by the following equation:

$$\frac{hD}{k} = K \frac{(VDr)_m}{u} \quad \frac{(uC_p)_n}{k}$$

where h = mean transfer coefficient, btu/hr-ft²-F.
V = velocity of the gas, ft/hr.
D = characteristic length (dia of piston crown), ft.
k = thermal conductivity, btu/hr-ft-F.
u = dynamic viscosity, slug/ft-hr.
r = density, slug/ft³
C_p = specific heat, btu/slug-F.

The above equation demonstrates how the various gas properties affect the heat flow into the piston. The mean

(*Turn to page 69, please*)

BEGINNING

OF A

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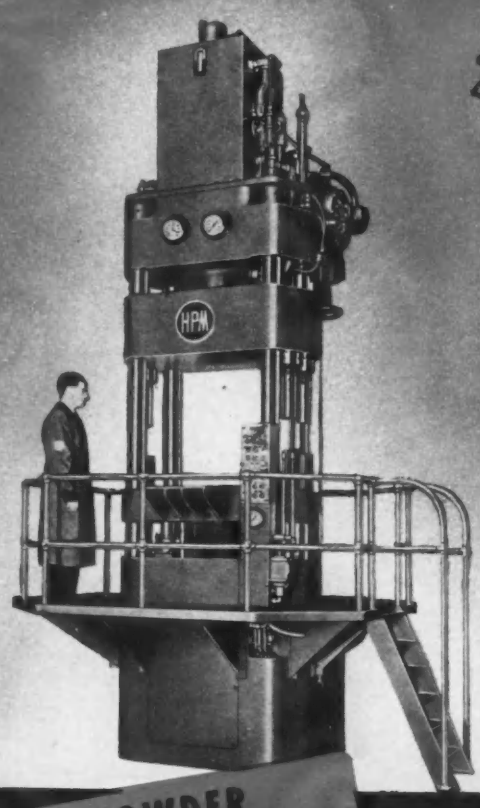

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FOR 194X PRODUCTION

With higher labor costs, it is requisite that postwar metal products be produced faster per man hour than they were in 1941. The answer to this problem is fewer rejects and faster production. H-P-M FASTRAVERSE presses are well known for their efficiency and fast operating cycle. They are rapidly replacing slower hydraulic presses, and less efficient mechanically operated machinery. Have you investigated the latest type of H-P-M FASTRAVERSE press for the pressure processing of metals? Regardless of your metal working problem, whether it be sheet metal working, forging, die casting or powder metallurgy, there is an H-P-M press that will do the job cheaper, faster and better. In many cases, first costs are no more than any other types of equipment.

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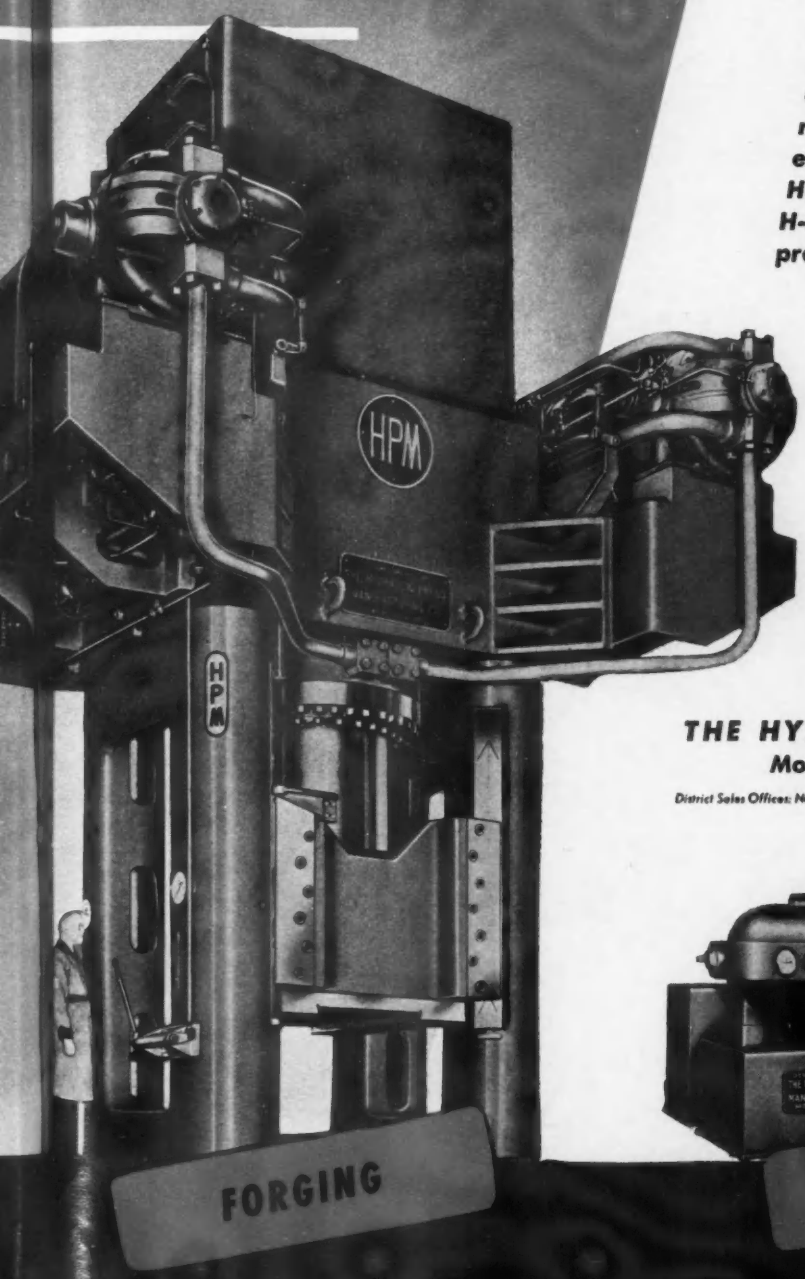

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It is evident that speed is of primary importance in forging hot metals. The powerful squeeze of the high speed hydraulic press has revolutionized forging practice. Proper metal flow and advantageous grain structure are direct results. The H-P-M FASTRAVERSE press is pioneering a new press forging era. High speed action, free from the sharp die impact of mechanically applied force, has made the self-contained H-P-M press the answer to modern forging problems.

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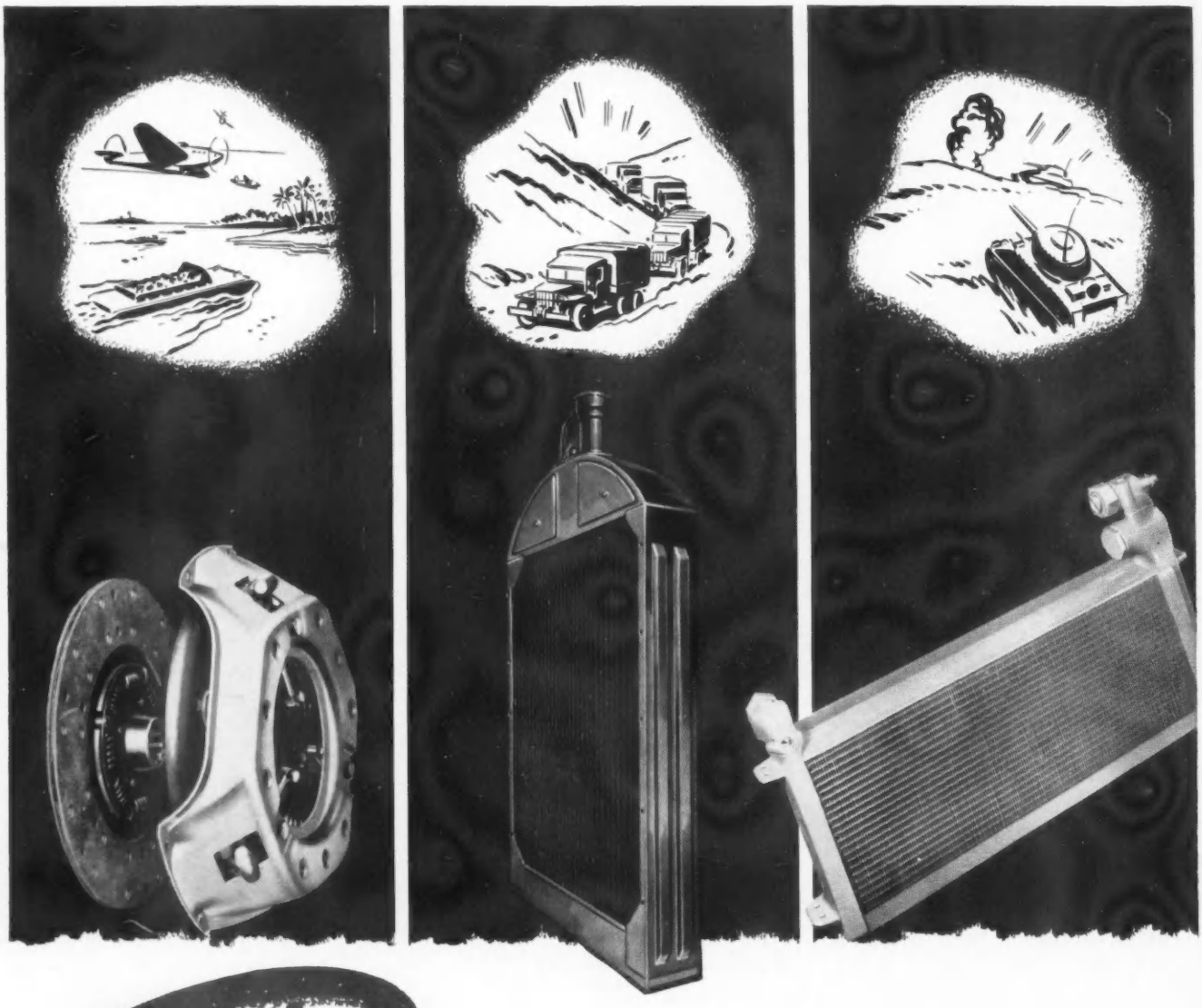

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(*Continued from page* 64)

value of h for a given case is a function of the gas velocity; as the velocity increases, the coefficient is increased. Since this velocity is a result of the turbulence in the combustion chamber, it is evident that more heat will be transmitted to the piston crown at points of greatest turbulence. Therefore, to avoid localized over-heating of any portion of the piston head, careful turbulence control is indicated. The minimum turbulence for complete combustion is imperative for maximum power output.

Outlook for Postwar Diesel Fuels

By Arch L. Foster
Petroleum Publishing Co.

POSTWAR Diesel fuel specifications should not be set higher than necessary for good, average operation. There has been a tendency in the industry to call for fuels with cetane numbers, indices, etc., excessively high and out of proportion to benefits derived. Fuel refiners can match most any requirement along these lines but the matter of cost and availability of supply would be adverse to the user's best interests, and needlessly penalize him.

Cetane number specifications have fallen into the "45-50" class in the past, with some as high as 60 and others as low as 35. It is now felt by leading oil technologists that a common average of 40-45 would best serve postwar industry. They argue that this specification is satisfactory for most Diesel operations and that, with the exception of the high speed ranges, low cetane fuels provide better fuel economy.

Engine Performance with Low Cetane Number Fuels

By L. W. Griffith, Shell Oil Co., Inc. and R. C. Williams, Caterpillar Tractor Co.

THE unavailability of the proper cetane number fuel for Diesel engines located in remote places occasioned some thought as to the result of using too low a cetane number. In the case of the Alcan Highway project, for example, the only available fuel, with a sufficiently low pour point, had a cetane number of only 35. Since this fuel did not meet Army specifications and its dependability was questionable, a testing program was arranged by the War Advisory Committee of the Coordinating Research Council.

Laboratory tests showed that there was little, if any, loss of maximum power with low cetane fuels. The specific fuel consumption remained the same or was better, in some instances. Engine roughness, combustion "knock" and peak pressures were observed to increase to some extent as the cetane number decreased. The exhaust smoke and temperatures were nearly identical for all fuels (normal cetane and low cetane).

In a series of field tests, 35 cetane fuel was compared with the normal 48.5 fuel and it was found that the use of the lower cetane number did not cause trouble with the engine parts. Acceleration and power tests revealed that two of the engines tested were sensitive to cetane number change while three others were sensitive to heating value only.

Cold room tests were the third, and last, method of study of this problem. Warm-up, idling and high altitude operation were investigated for 35 cetane fuel with 60 cetane used as a checking base. Similar difficulties were encountered with both fuels, however, the lower cetane fuel showed a higher degree of trouble to be anticipated.

As a result of all tests and studies made, it was finally determined that—the 35 cetane fuel may be used satisfactorily under normal temperature and altitude conditions; existing automotive Diesel engines can be operated at subzero temperatures on this fuel, but certain precautions must be taken to avoid possible trouble; long idling periods must be avoided, especially just before stopping the engine; engines should be kept warm when not in operation to avoid "missing"; and, operational trouble should be expected at high altitudes.

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Yes, it takes power and plenty of it to get them there and back—and it's the smoothly running Diesels in a PT's hold that give these lightweights of the Navy their fighting heart.

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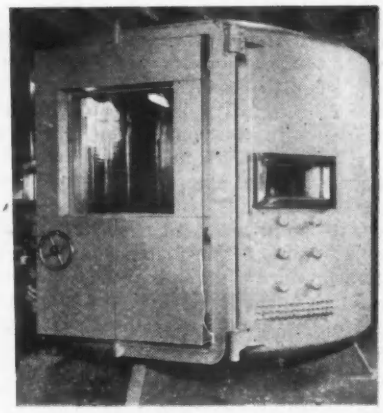
The chamber can be used also to measure warmth in clothes and shoes for high-altitude flyers, or to investigate physical properties of metals and fuels required for aircraft. Its size makes possible many examinations hitherto impossible.



Stratosphere chamber made by Kold-Hold Mfg. Co.

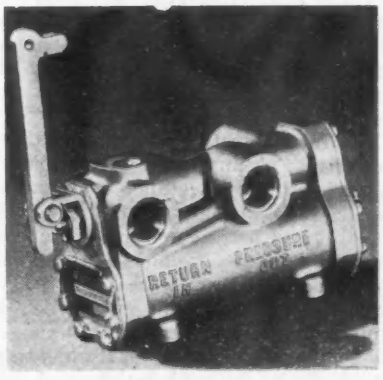
Full view of testing within the chamber is afforded by two inspection ports, one on each side of the door, and through the glass of the door itself. All transparent areas are constructed of several sheets of glass hermetically sealed to provide positive thermal insulation, to withstand excessive pressures, and to eliminate possibility of frosting.

A separate instrument panel accommodates all necessary controls and switches, as well as recording instruments which keep permanent logs of heating, cooling, humidifying and evacuating of the air within the tank.

The chamber is brought down from room temperature to its lowest level of 67 degrees below zero Fahrenheit in 90 minutes. The highest point to which it is heated by electric heaters, mounted in the housing, is 194 deg. F.

Hydraulic Fuse

The Aeroquip Hydrofuse, made by the Aeroquip Corporation, Jackson, Mich., is designed to function in hydraulic systems in a manner comparable to a circuit breaker in an electrical system. It does away with the loss of use of hydraulic services in an airplane due to breaking of a single line.



Aeroquip Hydrofuse

FILE THIS PLEASE MISS MITCHELL

...It's a folder from the Campbell people about their complete range of Abrasive Cutting Machines

● Yes, you will want this folder in your file. It's a sort of digest of the complete line of CAMPBELL ABRASIVE CUTTING MACHINES, with references to more detailed catalogs covering each type.

Let this folder serve as a reminder that CAMPBELL engineers are at your service—ready and able to work up cost sheets and practical production procedure for you, based on actual production records of CAMPBELL Machines. They ask you to state (1) materials, (2) shapes and sizes you are cutting, (3) lengths before cutting, (4) lengths of cut-off pieces and (5) required production per hour.

CAMPBELL ABRASIVE CUTTING MACHINES are currently cutting all grades of steel, annealed and unannealed, non-ferrous alloys, plastics, glass and ceramics—solid bars, tubular and flat stocks.

Write for the above folder—or for information on any specific cutting problem you may have.

Campbell ABRASIVE CUTTING MACHINES

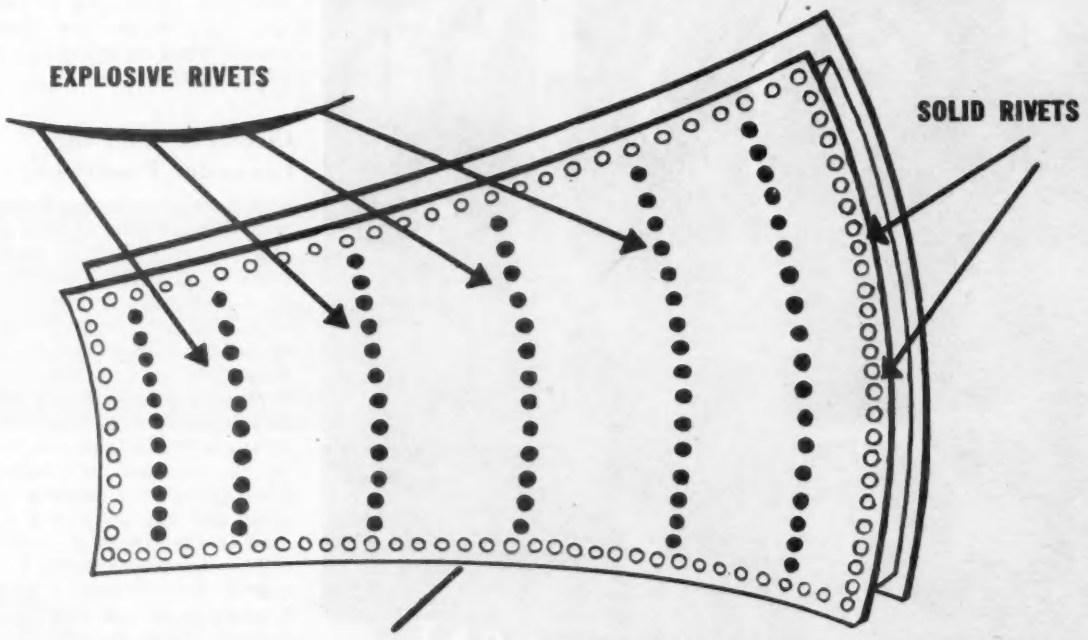
ANDREW C. CAMPBELL DIVISION • Bridgeport, Connecticut

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

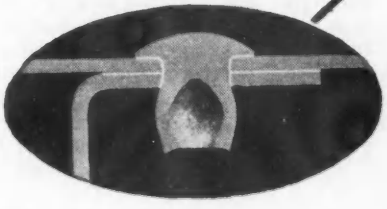
AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

APPLYING THE INNER SKIN OF A NACELLE DOOR ...IN A HURRY



Another typical job for Explosive Rivets



NO LONGER is blind riveting a production line bottleneck. Today, inner skins of landing gear and bomb-bay doors and similar blind riveting jobs are done in a jiffy . . . thanks to Du Pont Explosive Rivets.

These rivets simplify blind riveting operations. One riveter can readily set from 10 to 20 Explosive Rivets a minute.

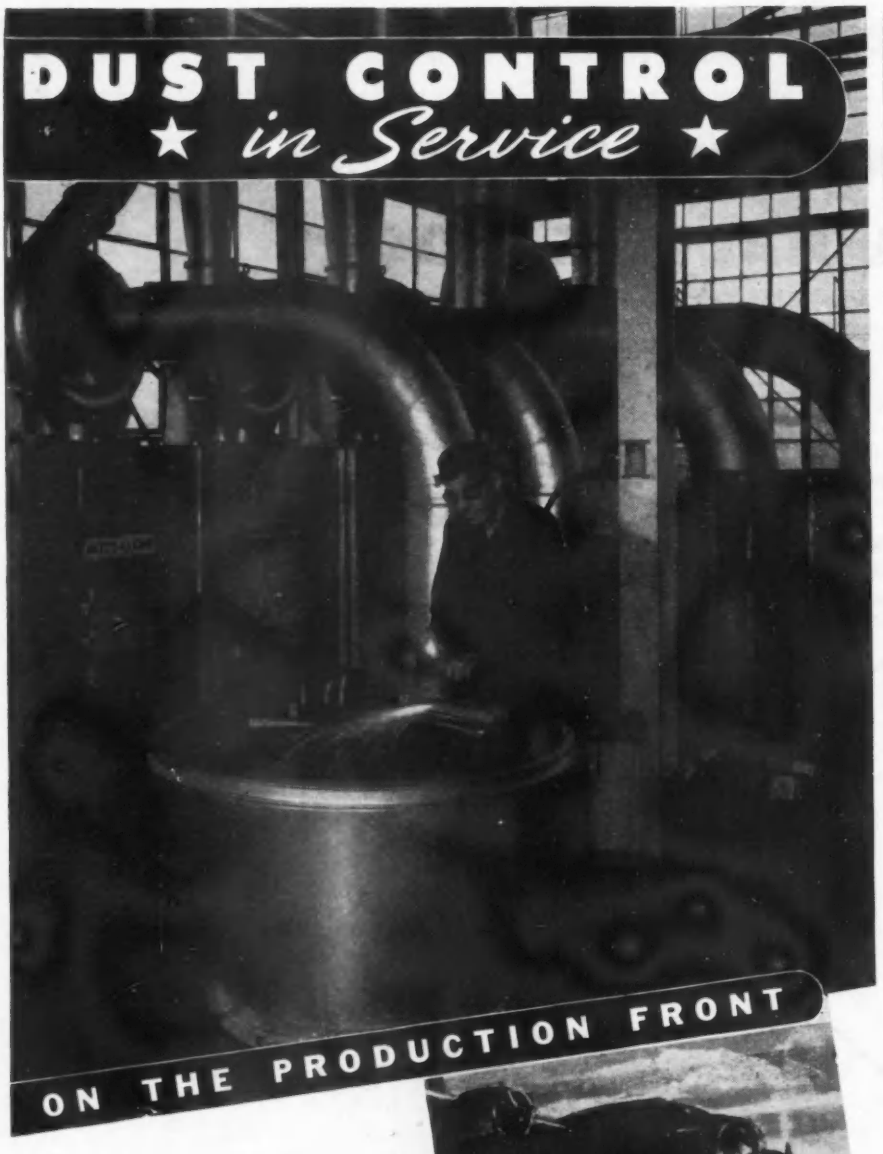
The rivets are inserted in drilled holes. The tip of an electrically heated Du Pont Riveting Iron is then applied to the rivet head. This fires a tiny charge concealed in the shank of the rivet, forming a strong, one-piece blind head that firmly sets the rivet in place. No further operations are required to complete the job.

Here's blind riveting at high speed... an easy way to do a tough job quickly. Consider Du Pont Explosive Rivets. They're saving time and costs on many production lines and in repair shops. Write for folder: "How to use Explosive Rivets." E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., 5494 Nemours Building, Wilmington, Del.—5-238 General Motors Building, Detroit, Mich.—5801 South Broadway, Los Angeles, Calif.

DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVE RIVETS

The one-piece blind fastener



Production for war forever established the importance of adequate industrial dust control, and the return to peacetime manufacture will again emphasize its need.

Already, AAF engineers are planning dust control systems for companies whose post-peace plans are crystallized. It's not too early now to plan for V-Day production. May we help you? There is no obligation involved in bringing your anticipated dust problems to us today. Write for booklet, "AAF In Industry", which describes the complete line of AAF equipment for every dust control need.

BUY WAR BONDS

AAF
AMERICAN AIR FILTERS

AMERICAN AIR FILTER CO.
INCORPORATED
449 CENTRAL AVENUE LOUISVILLE, KENTUCKY
IN CANADA: DARLING BROS., LTD. MONTREAL, P.Q.

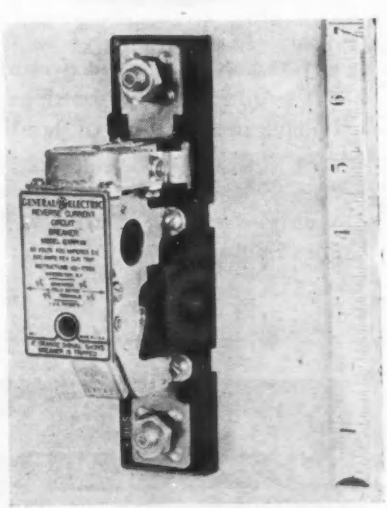
The Hydrofuse operates on the return-flow principle wherein any malfunction of the hydraulic system, such as a ruptured line, which causes a diminution of the return flow through the Hydrofuse causes it to shut off and thus prevent waste of hydraulic fluid. After "fusing" the Hydrofuse may be reset either by manual or hydraulic means, thus permitting use of undamaged circuits. Ordinarily a single Hydrofuse will protect the entire hydraulic distribution system in an airplane at a cost in weight of approximately 1.7 lb. Ease of installation was carefully considered in the design so that lines would not have to be rerouted when applying the device to existing aircraft.

Circuit Breaker for Generator Protection

A new d-c, reverse-current, air circuit breaker has been brought out by the General Electric Company, Schenectady, N. Y. Designated Type XRP, it is a circuit-protective device designed especially for aircraft use and built to satisfy Army Air Forces specifications. Rated 400 amp, 30 v, with a reverse-current trip setting of 300 amp and interrupting rating of 8000 amp at any altitude from sea level to 50,000 ft, the breaker is connected in the generator circuit between the generator relay and the positive bus—one being used in the circuit of each generator.

The standard breaker has a reverse-current trip setting of 300 amp which is suitable for use with standard 28.5-v aircraft generators of either 200- or 300-amp rating. The current-interrupting capacity is sufficient for use on systems employing up to six 300-amp generators, and up to three storage batteries. Small values of reverse current occur in normal operation when, for example, the generator speed is reduced to a point at which its generated voltage is lower than the bus voltage. In this case, the generator relay operates to disconnect the generator from

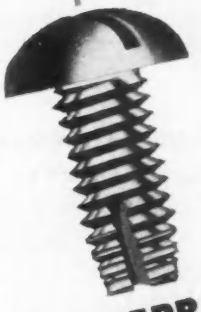
(*Turn to page* 105, *please*)



Type XRP circuit breaker

THE NEW MATERIALS DEMAND NEW FASTENING TECHNIQUES!

. . . . THROUGH EXACTING RESEARCH SHAKEPROOF ENGINEERS CAN COUNSEL YOU ON TYPES OF FASTENINGS AND METHODS OF ATTACHMENT FOR ANY APPLICATION!



SHAKEPROOF TYPE 1

THREAD-CUTTING SCREWS

Actually cuts its own thread in metals of any thickness —eliminates taps and tapping operations. Snug, tight fit always certain. Special type for plastics.

Write today

FOR FREE TEST KIT No. 22

Your new product of improved light metal, plastic or processed wood demands correctly engineered fastening methods to assure speedy assembly, lower production costs and peak performance.

Shakeproof engineers, through laboratory research and vast field experience, thoroughly understand the assembly problems brought about by metallurgical and chemical advances in material processing. They can recommend the type and method of fastening that is best suited to your particular product . . . and to the requirements of your own assembly line.

Write today—a Shakeproof field engineer will be immediately assigned to discuss with you the particular fastening needs of your products.

ARMY (E) NAVY

SHAKEPROOF INC.

"Fastening Headquarters"

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS

2501 North Keeler Avenue, Chicago 39, Illinois

Plants at Chicago and Elgin, Illinois • In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

Shakeproof Lock Washers with Exclusive Tapered-Twisted Teeth

Shakeproof Type 25 Thread-Cutting Screws for Plastics

Semi Fastener Units Pre-Assembled Shakeproof Lock Washer and Screw

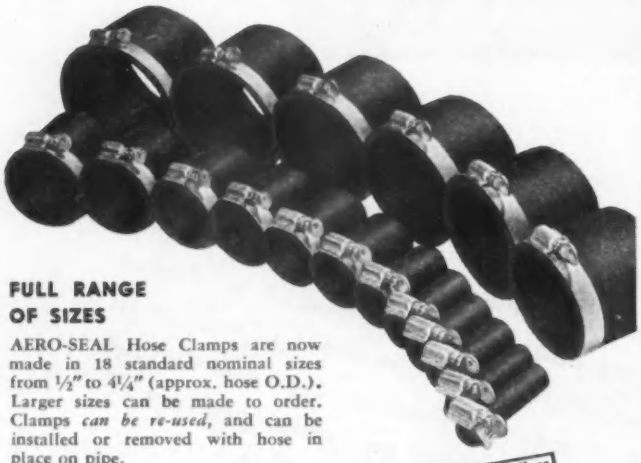
Shakeproof Cowl Fasteners . . . "The Quick-Opening Lock"

WORM GEAR ACTION

This shows the AERO-SEAL worm and worm gear action. The result is a belt-like tangential tightening action which assures uniform pressure around the entire periphery and holds tight under severe vibration *without lock wire.*

"Aero-Seal" HOSE CLAMPS

This outstandingly successful new type hose clamp was specially designed for aircraft applications, and has proved its dependability with millions now in service. It meets, or exceeds, all requirements of Army-Navy Specifications AN748 and AN-FF-C406a.



FULL RANGE OF SIZES

AERO-SEAL Hose Clamps are now made in 18 standard nominal sizes from ½" to 4¼" (approx. hose O.D.). Larger sizes can be made to order. Clamps *can be re-used,* and can be installed or removed with hose in place on pipe.

QS100 Dash No.	Nominal Clamp Size	Extreme Range of Clamp Diameter		AN894 or 878 Hose		Self Sealing Hose	
		Max.	Min.	Preferred I.D.	Will also fit I.D.	Preferred I.D.	Will also fit I.D.
M4	½	11/16	7/16	5/16 & ⅜	¼		
M6	⅝	13/16	½	5/16 & ⅜	5/16, ⅜		
M8	¾	61/64	9/16	7/16 & ½	5/8		
M10	⅞	1 5/64	⅝	⅝	¾	5/16, ½, 5/8	
M12	1	1 9/32	11/16	¾	⅞ & 1	⅝, ¾	⅝, ¾
M16	1¼	1 17/32	1 3/16	⅞ & 1	1¼	1	1
M20	1½	1 25/32	1¼	1¼	1¼, 1⅜	1¼	
M24	1¾	2 1/32	1 7/16	1½	1¼, 1⅜, 1½	1½	1¼
M28	2	2¼	1⅝	1¾	1⅜, 1½		1½
M32	2¼	2½	1⅞	2	1¾	2	
M36	2½	2¾	2⅛	2¼	2		2
M40	2¾	3	2⅜	2½	2¼	2½	
M44	3	3¼	2⅝		2½		2½
M48	3¼	3½	2⅞	3			
M52	3½	3⅝	3⅛				
M56	3¾	4	3⅜	3½			
M60	4	4⅛	3⅝				
M64	4¼	4½					

SIZE, TAKE-UP, & HOSE DIA. DATA

Diametral take-up is more than double the amount required to cover variations in hose diameter and change in service. *Write for sample clamps.*

AIRCRAFT Standard PARTS CO.

Aircraft Standard Parts Co.

1717 NINETEENTH AVENUE • ROCKFORD, ILLINOIS

Packard to Resume Production Of Parts for Civilian Vehicles

Packard Motor Car Co. has been granted permission by the Facilities Division of WPB to expend $975,000 for the rearrangement and alteration of facilities at its Detroit plant. Some of the alterations will permit Packard to resume production of vitally needed replacement parts for civilian vehicles. However, John H. Middlekamp, director of the Automotive Division of WPB, emphasized that the parts facilities being put into production will be utilized 90 per cent for military and other government orders and only 10 per cent for civilian passenger car parts.

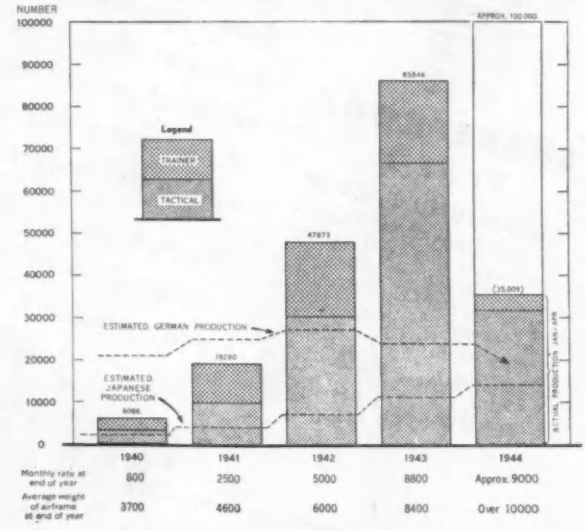
Unlike any other passenger car manufacturer, Packard had ceased entirely the production of civilian replacement parts. Packard was one of the first companies to enter the war production program on a large scale, undertaking an order for 9,000 Rolls-Royce aircraft engines for the U. S. and Great Britain in August, 1940.

Although Packard's aircraft engine and other war orders have not diminished, the company in recent months has been able to add a number of competent subcontractors for the making of aircraft engine parts. One hundred and thirty-nine new subcontractors have been added since December. Previously, Packard had been able to subcontract for some automotive replacement parts that were needed in the field but this arrangement has not been too satisfactory from the standpoint of quality and deliveries.

The Packard contract calls for re-installation of existing automotive machinery and equipment at a cost of $546,-228; alterations to open a machine shop area, $294,772; reopening of a cast iron foundry, $54,000, and installations for the improved handling of scrap disposal facilities in the manufacture of aircraft and marine engines, $84,000. With the exception of $46,000 for new equipment to round out certain production lines, all of the machinery to be used is already on hand. The parts facilities will be used not only for Packard military orders but to supply other companies as well, especially with castings such as cylinder blocks and cylinder heads.

Annual U.S. Production of Military Airplanes

Showing Actual and Estimated Production for 1944

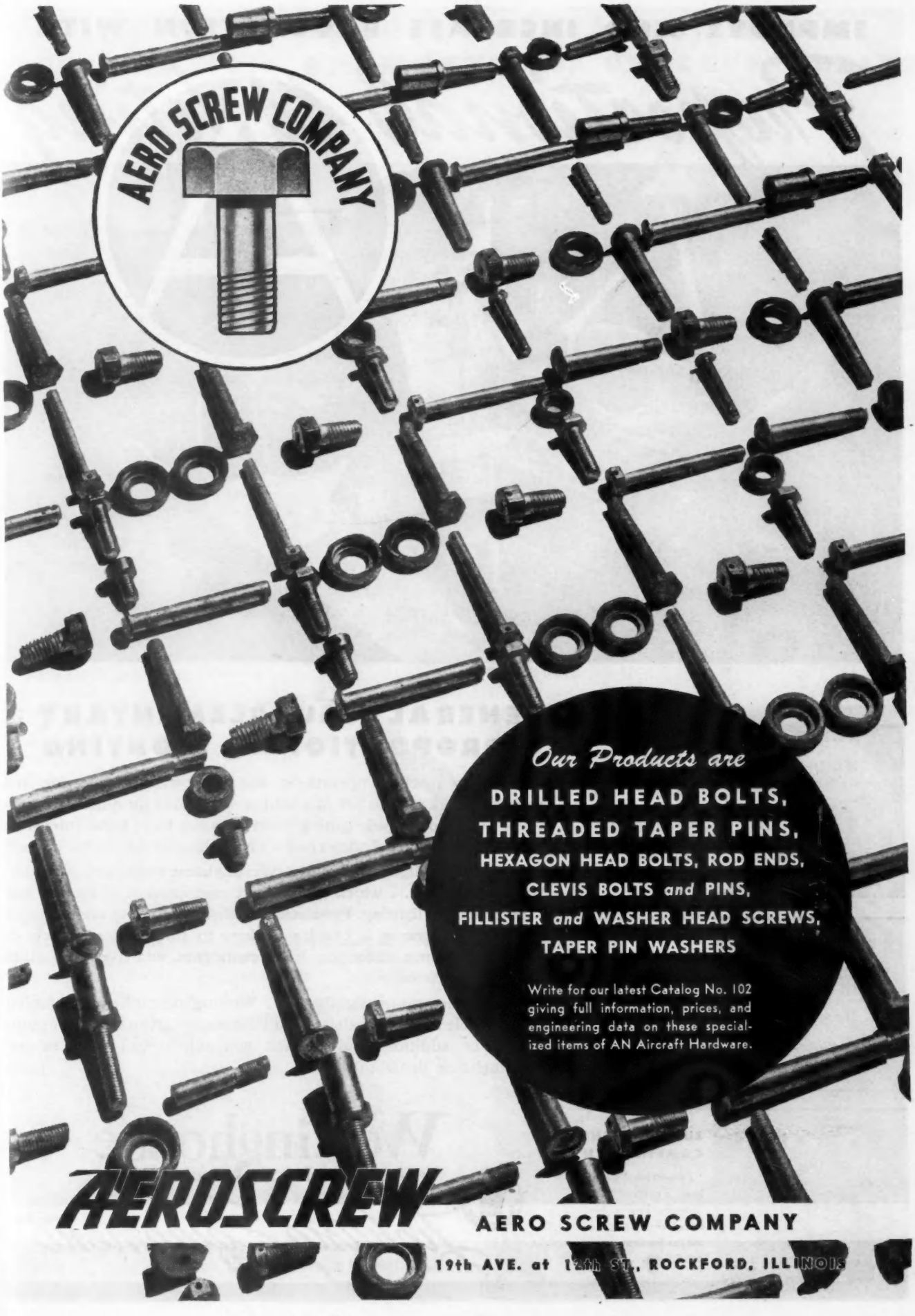


Note. U. S. aircraft production in 1936 was 1150 and in 1938, 1800. For these years estimated German production was 5000 and 10,000 respectively.

Annual U. S. and British production of military airplanes:

Year	No. of Planes	Total Airframe Weight (lb)	Total Value of Aircraft Output	British Production
1941	19,290	85,700,000	$1,765,000,000	23,210
1942	47,873	292,600,000	6,285,000,000	27,127
1943	85,946	743,000,000	13,800,000,000	28,054
1944	100,000*	1,250,000,000	21,300,000,000	.....

*—Scheduled; 1944 actual output through April 35,009 planes.


AERO SCREW COMPANY
Our Products are
DRILLED HEAD BOLTS,
THREADED TAPER PINS,
HEXAGON HEAD BOLTS, ROD ENDS,
CLEVIS BOLTS and PINS,
FILLISTER and WASHER HEAD SCREWS,
TAPER PIN WASHERS
Write for our latest Catalog No. 102 giving full information, prices, and engineering data on these specialized items of AN Aircraft Hardware.
AEROSCREW
AERO SCREW COMPANY
19th AVE. at 12th ST., ROCKFORD, ILLINOIS

IMPROVE AND INCREASE PRODUCTION WITH

Proportional lighting

NOT THIS

Good general lighting alone may not always provide adequate light on very critical work areas.

NOT THIS

Intense localized lighting with too little general illumination tends to cause eyestrain.

BUT THE RIGHT COMBINATION

"Proportional Lighting", a ratio of 1 to 5 between general and localized lighting, makes for best seeing conditions.

GENERAL + SUPPLEMENTARY = PROPORTIONAL LIGHTING

In many machine operations, and in precision inspection and assembly work, 100 to 300 footcandles are needed for quick, accurate vision. Good overhead lighting often does not meet these intensities . . . or is nullified by shadows cast by a machine or the worker himself.

To solve this lighting problem, Westinghouse recommends proportional lighting . . . which is the right combination of general and supplementary lighting. Proportional lighting improves and increases production—because it enables workers to adhere more closely to "specs"—perform their job with confidence and precision—thus increasing their output.

For supplementary lighting . . . Westinghouse offers a complete new, flexible line of Focalaires. Full details are given on the opposite page. For additional information and prices—call your nearest Westinghouse distributor.

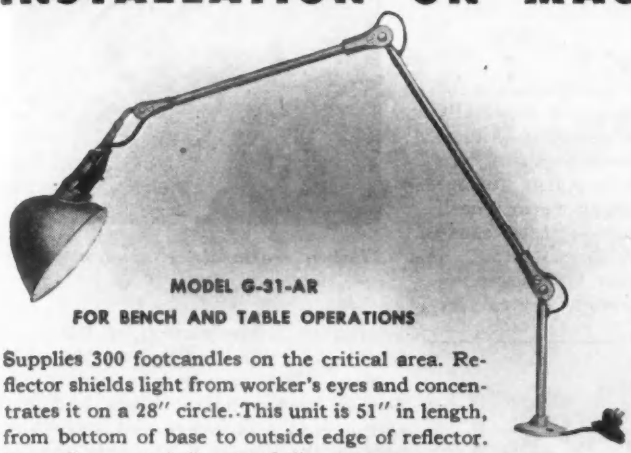
J-04005

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Lighting Equipment

6 WESTINGHOUSE FOCALAIRES...FOR INSTALLATION ON MACHINES, BENCHES, TABLES



MODEL G-31-AR

FOR BENCH AND TABLE OPERATIONS

Supplies 300 footcandles on the critical area. Reflector shields light from worker's eyes and concentrates it on a 28" circle. This unit is 51" in length, from bottom of base to outside edge of reflector. Base 8", arms 11½" and 16½", reflector assembly 12" long.

MODEL A-20-BR

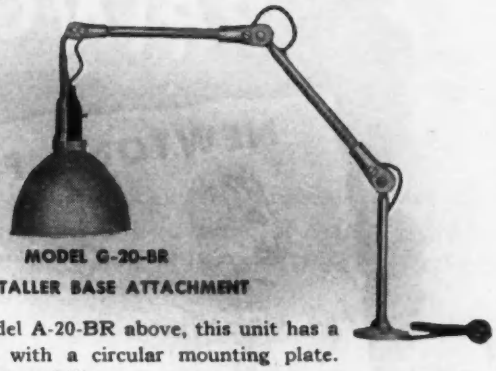
FOR LARGER MACHINE TOOLS

Designed for use where a broader diffusion of light is desired. Provides 150 footcandles at a distance of 12 inches from the reflector. Over-all length is 32", base 1¾" high, arms 10½" and 9½", reflector assembly 10¼". Bracket-type base can be mounted in a space 3" by 1"

MODEL B-31-AR

WITH SHORTER BASE ATTACHMENT

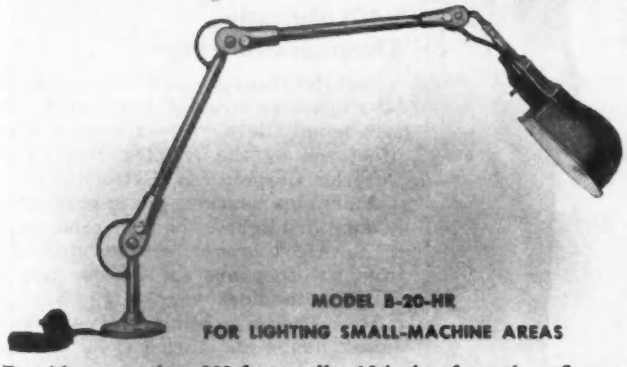
Identical with Model G-31-AR above, except that the base is only 5⅛" high, making the over-all length 48⅛". Ball-clip joints permit quick, easy adjustment.



MODEL G-20-BR

WITH TALLER BASE ATTACHMENT

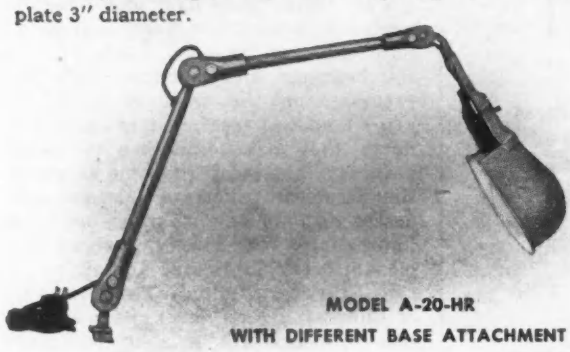
Similar to Model A-20-BR above, this unit has a base 8" high, with a circular mounting plate. Over-all length is 38¼".



MODEL B-20-HR

FOR LIGHTING SMALL-MACHINE AREAS

Provides more than 200 footcandles 12 inches from the reflector, on a work area 20" by 16". Over-all length is 35⅝", base 5⅛", arms 10½" and 9½", reflector assembly 10½". Circular mounting plate 3" diameter.



MODEL A-20-HR

WITH DIFFERENT BASE ATTACHMENT

This unit is the same as Model B-20-HR except that it has a short 1¾" base and narrow type of mounting bracket.

IMPORTANT FEATURES OF THE WESTINGHOUSE FOCALAIRE

1. Quickly adjusted by simple ball and socket joints.
2. Shake-proof—resists vibration of machine.
3. All parts are welded for strength.
4. Wire is run inside of tubular arms and has oil-resistant insulation.
5. Reflector is spot-welded to socket guard.
6. Furnished in 6 standard types, with regular machine tool gray finish.
7. Special sizes can be made up from standard part of arms, reflectors and bases.

Westinghouse

FOCALAIRE

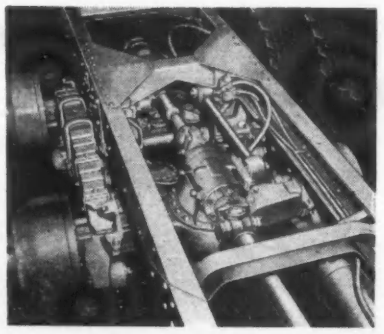
New Products

Tandem Axle Unit for High Torque Operations

While the SW-3002 Series worm drive tandem axle unit, named "The Westerner," recently added to the line of axles made by the Timken-Detroit Axle Company, Detroit, Mich., is basically similar to the worm drive axles produced by Timken since 1912, it incorporates many new improvements for high torque operations, and especially for long hard pulls on mountain grades.

Increased worm centers permit the use of a larger diameter worm, stronger worm shaft and larger worm wheel, with consequent reduction in pressure per square inch on the worm teeth.

Controlled lubrication is assured by a close-fitting oil trough or carrier around the rear portion of the worm wheel and an oil housing over the worm.



Timken worm drive tandem axle unit

More rigid carrier legs prevent deflection under heavy loads and high torque, and a 14-dowel stud attachment secures the carrier to the axle housing. Larger differential and increased capacity bearings assure long life in the heavy duty highway service for which "The Westerner" is designed.

Timken "P" power brakes are used on "The Westerner." Open type malleable iron brake spiders and 16½-in. diameter drums assure adequate ventilation for cool running with 20-in. base tires. Wide 6-in. liners reduce friction wear and fading. Constant lift "S" type cams, mounted in needle bearings, and heat-treated roller cam followers are said to assure even brake application with reduced friction and long life.

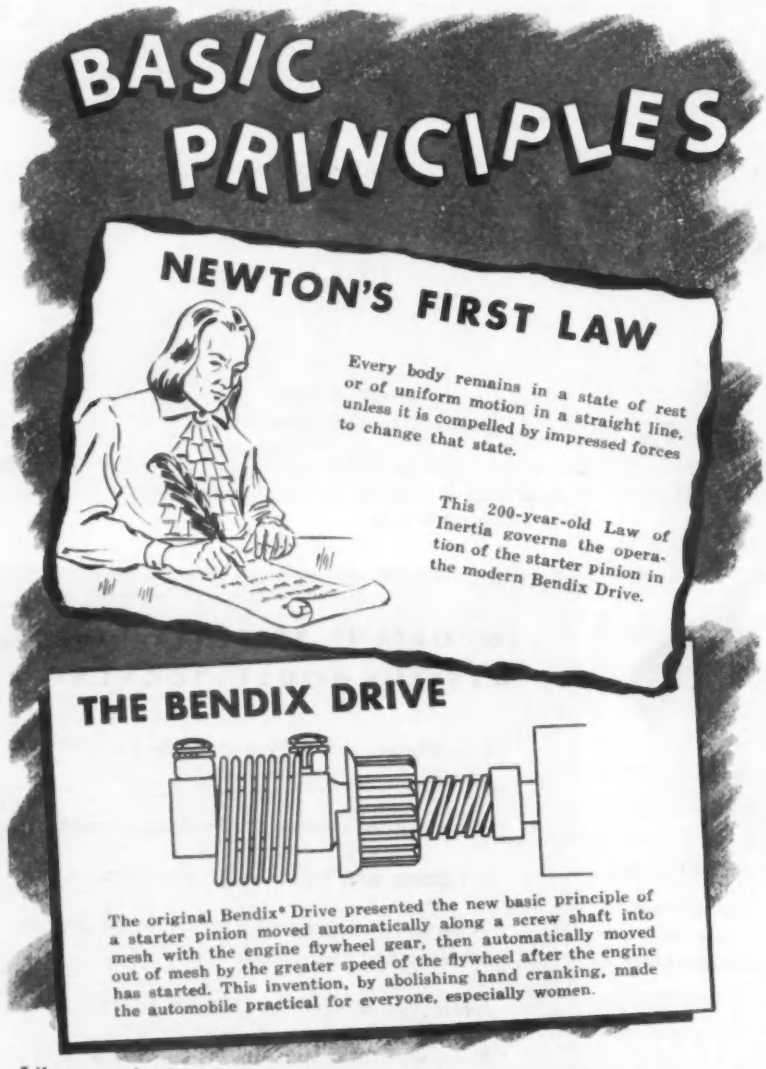
Self-Lubricating Aluminum Bearings

Self-lubricating powdered aluminum bearings—the first of their kind ever successfully developed—are being manufactured by the Amplex Division of Chrysler Corporation, Detroit, Mich.

Aluminum bearings are approximately one-third lighter than the same types in powdered bronze, copper, steel and iron, yet they are said to be capable of withstanding very high bearing loads. They are being made in cylindrical, flange and thrust type, and the manufacturer is equipped to make them in irregular and special shapes, and in machine parts.

The Oilite bearings and machine parts are pressed from powdered metals purchased on the open market. Both the bearings and machine parts are processed in the same manner, and after a special treatment in large furnaces they are re-pressed to insure accuracy. The bearings, some so porous that light can penetrate them at thicknesses up to one-eighth of an inch, are impregnated with special, non-gumming oil which self lubricates a shaft or fitting. Besides eliminating the necessity of lubricating attachments the sponge-like bearings are able to withstand quick-changing temperatures.

A finished part weighs exactly what the powder weighed when it entered the briquetting die. There is no waste


BASIC PRINCIPLES
NEWTON'S FIRST LAW
Every body remains in a state of rest or of uniform motion in a straight line, unless it is compelled by impressed forces to change that state.
This 200-year-old Law of Inertia governs the operation of the starter pinion in the modern Bendix Drive.
THE BENDIX DRIVE
The original Bendix* Drive presented the new basic principle of a starter pinion moved automatically along a screw shaft into mesh with the engine flywheel gear, then automatically moved out of mesh by the greater speed of the flywheel after the engine has started. This invention, by abolishing hand cranking, made the automobile practical for everyone, especially women.

Like every basic principle, the Bendix Drive permits virtually limitless variations. Used in more than 60,000,000 vehicles . . . from pleasure cars to jeeps, trucks, tanks, tractors, PT boats, and even helicopters . . . the Bendix Drive has proved its versatility and dependability. Bendix Engineers are available to help provide the most efficient, lowest cost answer to your starting problems.

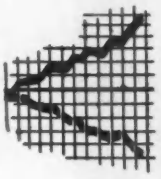
The Bendix Drive is an important member of "The Invisible Crew"—precision equipment which more than 30 Bendix plants are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW
Bendix Aviation Corporation
*Trade Mark of Bendix Aviation Corporation

ECLIPSE MACHINE DIVISION

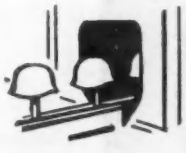
Here's why Nitrocellulose Lacquer is the finish to watch!

When you plan postwar finishes, just think of this: Nitrocellulose lacquer promises new possibilities. Don't overlook them —look them over!



Profits go up when costs go down, and the cost of finishing your product with nitrocellulose lacquer should be lowered by important changes now in process. Furthermore . . .

Higher solids content is the aim of extremely promising experimental work. By cutting down the number of coats required, this development will save time and labor, *further* reduce finishing costs. And, of course . . .



No drying equipment is needed, with its high initial cost, constant fuel and upkeep requirements, and inevitable depreciation. As always, nitrocellulose lacquers will *air-dry in minutes.* Their *color range* will be *unlimited.* They will still be tough, flexible, durable, resistant to water and chemicals. And above all, *easy and cheap to apply and repair!*

Write or call your lacquer supplier for specific aid on your finishing problems. Hercules makes no lacquers, but specializes on the manufacture of high-quality nitrocellulose and resins from which lacquers are made.

Continuous Research Pays Off

The Hercules Continuous Research Program is constantly at work for American Industry. It is continually finding *new* product improvements—*new* methods of handling, *new* end uses. *All* users of Hercules products share in the benefits of this research.

CELLULOSE PRODUCTS DEPARTMENT

HERCULES CL-44

964 Market St.
Wilmington 99, Delaware

to trim. Five seconds after powdered metal is fed to the presses a part is shaped and ready for heat-treating and re-pressing which requires proportionally the same amount of time.

Synthetic Rubber "Pliolite S-1"

Synthetic rubber "Pliolite S-1" has just been announced by The Goodyear Tire & Rubber Company, Akron, Ohio. Prewar natural rubber "Pliolite" was produced by Goodyear by a process which preserved all the original rubber's inherent characteristics while adding rigidity and low solution viscosity.

In anncuncing development of "Pliolite S-1," the synthetic rubber substitute for the natural rubber product, the manufacturer states that the new material has generally the same range of usefulness and applications as its natural rubber forerunner.

During the war period, however, practically all of Goodyear's production of "Pliolite S-1" will be confined probably to insulating wire and cable for the military forces, needs which are being supplied at present with the natural rubber production.

A special type of synthetic rubber was developed for "Pliolite S-1." After being transformed to a resin, this rubber is integrated by chemical and mechanical processes with the same type of synthetic rubber (GR-S) now being produced in plants built for the war emergency. This is the process for "Pliolite S-1" Master Batch used in electrical insulation.

In some respects, according to Goodyear, the "Pliolite S-1" is even superior to the prewar natural rubber product. It can be produced with the same range of colors and softening points as the original "Pliolite" and on the same Goodyear equipment.

BORG & BECK

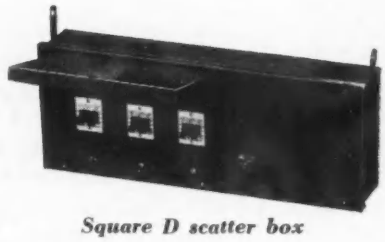
The Standard Clutch in Peace or War!

BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS

Circuit Breaker Scatter Boxes

Controlling temporary power and light circuits is now possible with a newly designed "Scatter box" offered by the Square D Company, Detroit, Mich. Designed primarily for ship yards and aircraft plants where a number of temporary circuits must be set up and torn down quickly, the scatter box is adaptable to other applications where the same requirements must be met.

The Square D device is built for from



Square D scatter box

four to eight circuits with or without neutral. Circuits are protected by 15 amp., 115 v. single pole, Type MO Multi-breakers (circuits breakers) although 20 or 25 amp. breakers can be substituted.

The hinged cover of the scatter box can be padlocked and openings for plug receptacles similar to Hubbel No. 7557-G are provided. One 1-in. knockout in each end is included and the box has a pair of ears for hanging. Receptacles or internal wiring are not provided.

Synthetic Rubber Base Sealing Tape

The Presstite Engineering Company, St. Louis, Mo., is producing tape of Thiokol synthetic rubber for sealing riveted fuselages, fuel tanks, gun turrets and other assemblies of airplanes against leakage. This Thiokol base tape is not soluble in most of the common solvents, including aromatic aviation fuel, ethyl and butyl acetate. Prolonged exposure to air does not harden the tape or change its consistency.

(*Turn to page* 202, *please*)

"PERFECT"
Oil Seals
PATENTED

Good lubricating oil in the housing of a machine protects its life and keeps it operating. When, through faulty sealing, the oil leaks out on to the floor or road surface, it becomes a nuisance, a hazard, or both. And in addition, bearings and machines are apt to starve to death. In any case it is an unnecessary waste that cannot be tolerated in these days of shortages.

An extremely simple and effective way to stop this waste is the carefully engineered use of self-contained "Perfect" Oil Seals which not only hold the oil in the housing but also keep foreign matter—dust and moisture—out.

Don't fail to consider these seals seriously in the design of postwar equipment.

CHICAGO RAWHIDE MANUFACTURING CO.

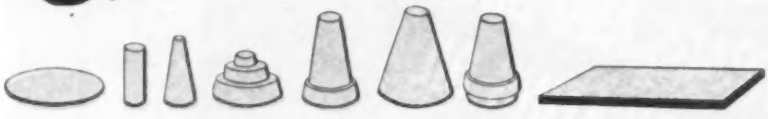
1310 ELSTON AVENUE • CHICAGO, ILLINOIS

PHILADELPHIA • CLEVELAND • NEW YORK
DETROIT • BOSTON • PITTSBURGH • CINCINNATI

65 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvene Synthetic Products

POREX*

Is Going Places!



***A POROUS METAL PRODUCED BY POWDER METALLURGY**

Porex is a highly porous metal, approximately one half void. It is available in four grades, providing accurately-controlled characteristics of particle stoppage and flow rate. Outstanding advantages of this unique product of powder metallurgy are:

Tortuous passages for more effective filtration, separation, etc. • Adaptability to fabrication in the most efficient shapes. • Adaptability to bonding to other parts. • Ductility that permits press fits. • Good strength characteristics. • Uniformity of production.

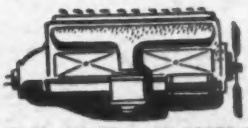
Write for Free Book of Engineering and Application Data

(Request Must Be on Company Letterhead)

MORAINE PRODUCTS DIVISION
GENERAL MOTORS CORPORATION
DAYTON 1, OHIO

Buy Extra Bonds—

LIVES DEPEND ON IT



AS A FILTER ELEMENT

In many of the Diesel engines which power machines of war, Porex is used as a filter to protect injector nozzle orifices from damage by foreign particles. Other applications involve removal of fine particles from gasoline, water, lubricating oil, air and gases.

AS A SEPARATION MEDIUM

In the air-conditioning and refrigeration industry, Porex elements separate oil or water out of refrigerants to protect valves and fine orifices. Other uses include separating oil from water, water from oil, water from gasoline, water from air in pneumatic equipment, etc.

AS A DIFFUSION MEDIUM

Wherever gases, liquids, or gases and liquids must be intimately mixed—or where the flow must be diffused over a wider area—Porex offers unusual qualifications. An example is the diffusion of gases passing into a drying chamber.

AS A FLOW-CONTROL MEDIUM

Porex plugs "meter" the flow of gases and liquids within accurate limits in varied applications where a definite flow rate is desired. A Porex filter is used ahead of the plug to prevent clogging.

AS A FLAME ARRESTER

An example of this function is the use of a Porex section bonded to a threaded plug, as a vent for explosion-resistant fuel pump motors used in military aircraft.

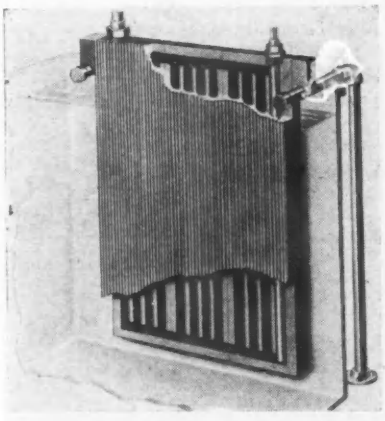
AS A VENT OR BREATHER

Where the presence of fine particles in the air circulation is undesirable, Porex breather discs are a "natural."

MORAINE PRODUCTS
DIVISION OF
GENERAL MOTORS

New Production Equipment

THE National Carbon Company, New York, N. Y., has brought out a corrosion resistant "Karbate" heat exchanger to meet the need for a chemically inert, mechanically strong heating (or cooling) unit for use in pickling tanks and other metallurgical applications. The "Karbate" material from which the heater is made is an impregnated graphite impervious to liquids under high pressures; it possesses high heat transfer values and is resistant to practically all acids, alkalis and solvents.

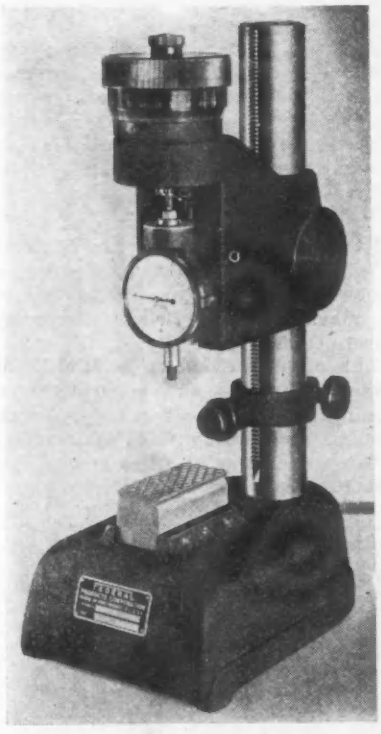


Karbate heat exchanger

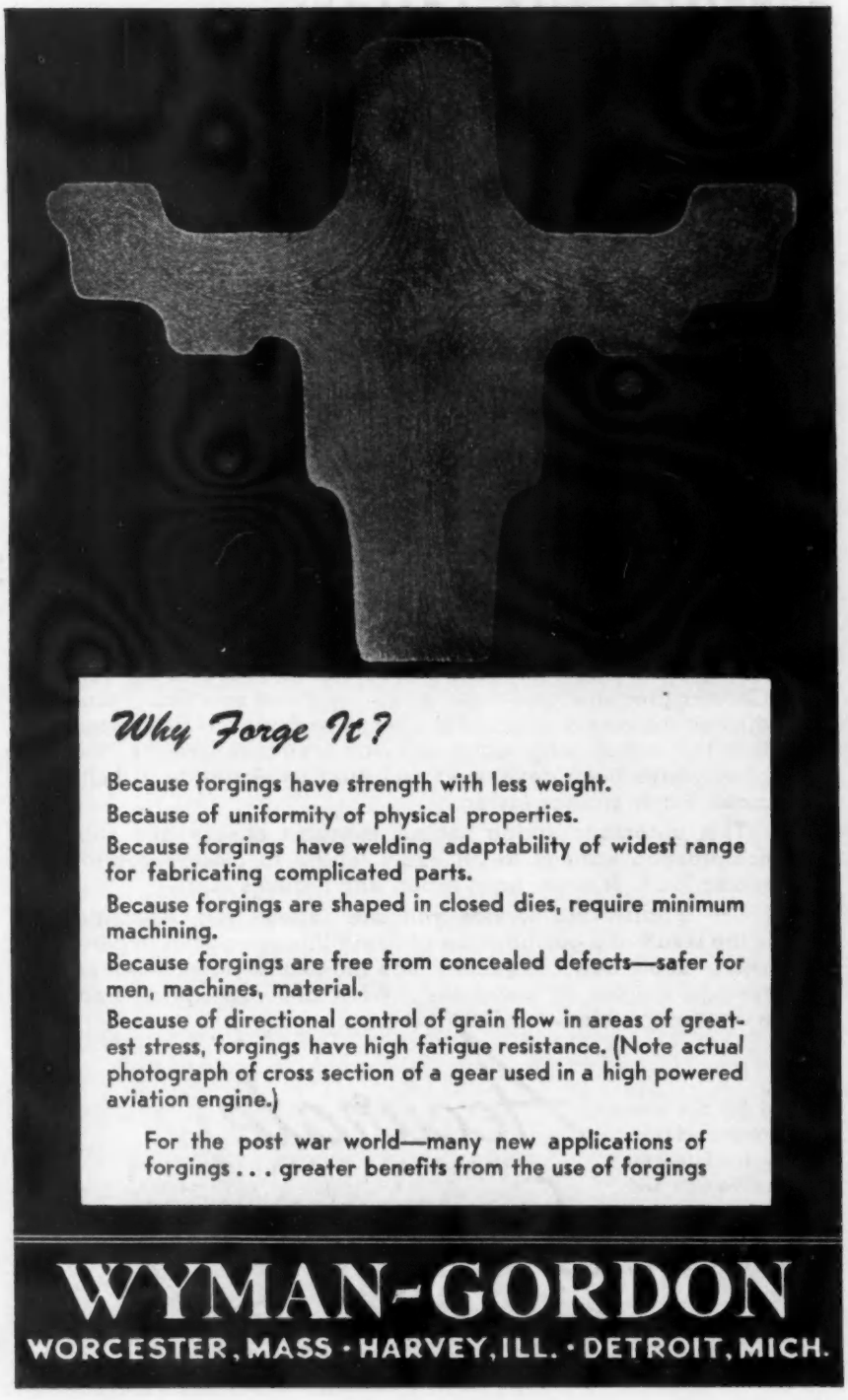
The exchangers are of plate type, employing the principle of extended, or corrugated, surface to attain maximum heat transfer area without bulkiness. Installation requirements and economical manufacturing methods caused National Carbon Company to adopt four standard design groups incorporating both parallel and series flow channels, thus making possible 30 different combinations to meet the widest range of heating and cooling requirements.

Small and interchangeable, the units are designed so that they can be readily adapted to various sizes of tanks; they can be mounted in multiple or single units, and need little space in the tank.

FEDERAL PRODUCTS CORPORATION, Providence, R. I., has added a combination micrometer and dial indicator, the Model 120B-1, to its line of measuring instruments. The microme-



Federal comparator with micrometer head


Why Forge It?
Because forgings have strength with less weight.
Because of uniformity of physical properties.
Because forgings have welding adaptability of widest range for fabricating complicated parts.
Because forgings are shaped in closed dies, require minimum machining.
Because forgings are free from concealed defects—safer for men, machines, material.
Because of directional control of grain flow in areas of greatest stress, forgings have high fatigue resistance. (Note actual photograph of cross section of a gear used in a high powered aviation engine.)
For the post war world—many new applications of forgings . . . greater benefits from the use of forgings
WYMAN-GORDON
WORCESTER, MASS · HARVEY, ILL. · DETROIT, MICH.

ter head of this device takes the place of gage blocks and the dial indicator comparator provides an instrument which is faster than the usual micrometer and requires less skill on the part of the operator. As the micrometer has a range of 1 in., the gage may be set to any dimension between zero and 4 in. by the use of a 1-in. and a 2-in. gage block.

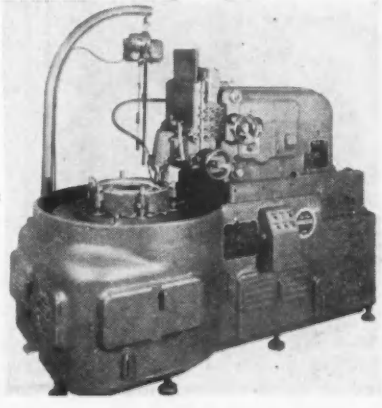
The Model 120B-1 is equipped with a Federal super-sensitive low friction dial indicator with .0001-in. graduations. Inspection of thread pitch diameters, by the three wire method, is facilitated by the micrometer head. An auxiliary weight, supplied as an extra, furnishes the additional pressure required for the coarser threads.

A NEW precision gear tooth shaving machine, the GCQ-36 in., has just been introduced by National Broach & Machine Company, Detroit, Mich., for the finishing of both internal and external gears from 12-in. to 36-in. pitch diameter. The design of this Red Ring machine is unique because of its simple selective control and the facility with which work parts are handled.

The principle of rotary crossed axes shaving used in the operation of this machine is the same as that around which other Red Ring finishing machines are built, but in this unit the work is carried horizontally on a power driven rotary work table.

The teeth of the work gear mesh with those of the cutter. The cutter, which is free to rotate, is driven by the work gear and at the same time is slowly reciprocated across the face of the work gear in a direction parallel to its axis. The cutter is fed into the work gear one increment at each reversal of direction in its reciprocating motion. Final work gear tooth size is controlled by the total amount of infeed over the entire cycle.

A self-contained hydraulic work ejector controlled by a foot pedal at the table end of the machine serves to lift the work part out of its quick clamping fixture. It serves also as a loading platform for the subsequent work part that is being loaded.

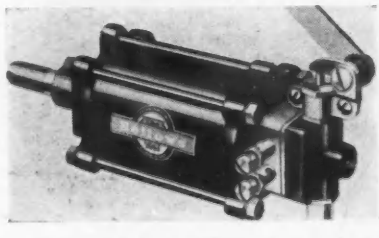


Red Ring gear tooth shaving machine

A power hoist, furnished as optional equipment, consists of a free swinging jib crane mounted on the machine base and a 500-lb capacity electric hoist with sensitive control that may be brought directly over the center of the table.

MANY hand operations can be made fully automatic by application of a new type air motor, just placed on the market by The Bellows Company, Akron, Ohio.

This air motor, known as Model BM, makes automatic such operations as feeding work to tools, tools to work, opening and closing vises and holding fixtures, operating clutches and latches, and provides a convenient source of



Bellows air motor

SETTING THE LENGTH TO CONTROL THE LOAD...

Automatically

Greater precision and closer control without sacrificing production remains a constant challenge to Accurate Engineers. It is the reason why many unusual machines like the one above have been developed and built by Accurate to help make *better springs faster.*

This automatic spring setting machine checks and sets compression springs to an *exact* length to closely control spring load. It saves time, labor, and reduces cost.

The quality and service you can expect from Accurate is the result of a combination of many things: special experience, "know how," ingenuity and interest in making better springs, quicker at lower cost. What are your spring and wire form problems?

Send for the new Accurate Handbook. It is full of informative data and formulae that you will want for your files. Free of course.

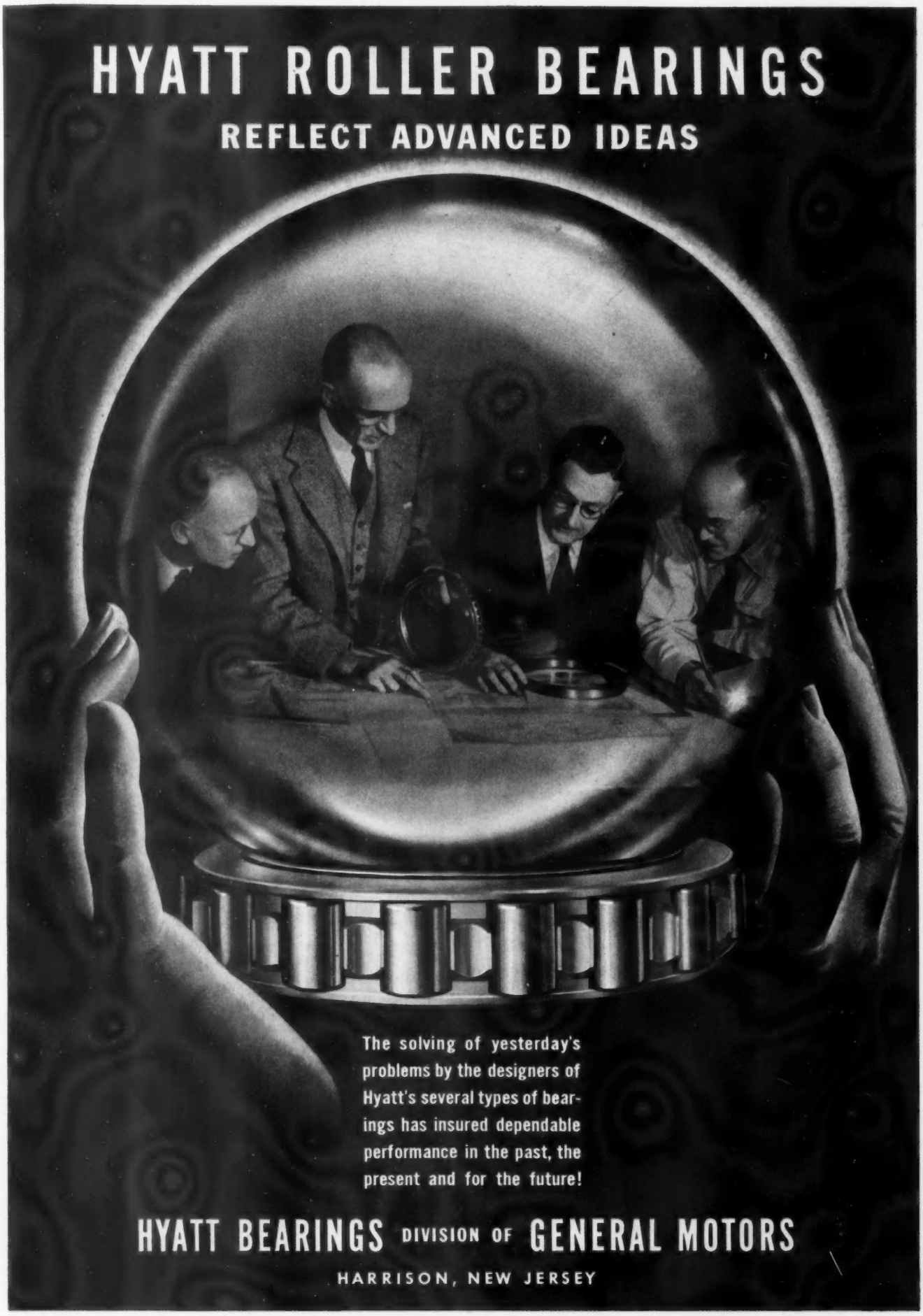
Accurate Springs

SPRINGS • WIREFORMS • STAMPINGS

ACCURATE SPRING MFG. CO., 3811 W. Lake St., Chicago 24, Ill.

HYATT ROLLER BEARINGS

REFLECT ADVANCED IDEAS



The solving of yesterday's problems by the designers of Hyatt's several types of bearings has insured dependable performance in the past, the present and for the future!

HYATT BEARINGS DIVISION OF **GENERAL MOTORS**

HARRISON, NEW JERSEY

"Weight Saved On a TWA Plane Worth $173.00 a Pound in 1943"

SAYS J. C. FRANKLIN
Vice Pres. of Engineering
Transcontinental & Western Air, Inc.

"SINCE September 9, 1943, the standard operating weight of TWA DC-3 aircraft, consisting of airplane, crew, oil, full equipment and meals, has been decreased 261 pounds per aircraft for summer operation and 279 pounds per aircraft for winter operation.

"Interpreted in terms of payload space, which TWA valued at $173 per pound in 1943, we have found that this weight reduction program has given us the equivalent of an additional DC-3 for our entire fleet of Skyclubs."

SEND FOR FREE BOOTS WEIGHT-SAVING BOOKLET TODAY

Comparative weights of various types of self-locking nuts comprehensively reviewed for the convenience of aircraft designers, engineers, operating and maintenance personnel. Copy will be sent you, free, on request.

BOOTS SELF-LOCKING NUTS

"They Fly With Their Boots On—Lighter"

Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn., Dept. H

BOOTS NUTS SAVE UP TO 60 LBS. PER PLANE

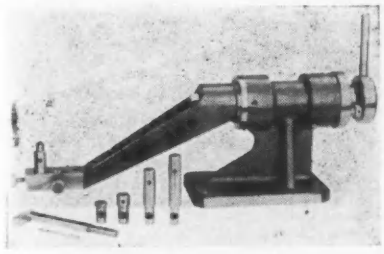
- Much lighter yet far tougher than other nuts.
- Standard fastenings on *all* types of military fighters, bombers, cargo carriers.
- In peacetime will be standard on commercial planes.
- Can be used over and over again.
- "Outlast the plane."
- Approved by all government aviation agencies.

This is one type of the famous Boots All-Metal Self-Locking Nut—set in straight or curved channel for fast assembly.

power for various staking, clamping, or embossing operations.

The Model BM air motor operates on any air pressure up to 175 psi. Power thrust is approximately five times operating air line pressure. The Bellows air motor is available in strokes ranging from 1½ in. up to 48 in. Heads are steel forgings. All moving parts are steel. Nose and foot mounts are standard equipment with front shelf and pivot mountings also available.

U. S. TOOL & MFG. CO., Dearborn, Mich., is producing a precision radius dresser with a capacity up to 4½-in. radius and identified as Model 45. It is built of cast iron and provided with Timken taper bearings. All

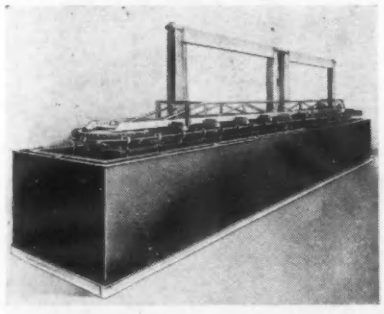


Model 45 radius dresser

unpainted, exposed surfaces are chrome plated. Graduations etched on a chrome plated ring, together with a lock on the spindle, provide means for exact location of the radius desired on the wheel being dressed. The spindle is sealed against dust with leather "closure seals."

THE Udylite Corporation, Detroit, Mich., offers a full automatic plater, 35 ft by 6 ft by 9 ft, which is sold as a complete unit and can be shipped, assembled, in one freight car.

The Udylite full automatic plating machine is new only as a unit. Its operating principles and various mechanisms have been in use on some of the company's equipment, for many years. A square type transfer system was worked out which requires less space and permits a wide variation of transfer speeds—lift, transfer and lowering rate being variable, independently.



Udylite full automatic plating machine

Racks are spaced on 18-in. centers, but this may be varied without readjustment of the transfer mechanism.

A single row carrier system avoids crowding and burning on turns with greater ease of loading and unloading. The unit handles up to 76 racks per hour, variable to work requirements. Heavy duty, copper anode and cathode rods afford positive self-aligning hook contact. A single, hydraulic mechanism provides smooth, positive transfer. Electric arc welded steel superstructure is counter-balanced so that transfer mechanism lifts only weight of eight loaded racks at one time.

ROUND tool bits, made either from Stellite 98M2 or Stellite Star J-Metal alloy, are furnished by Haynes Stellite Company, Kokomo, Indiana. These round tool bits are furnished centerless-ground to tolerances of plus 0.000 and minus 0.002 in. on the diameter, and plus or minus 1/6 in. on the length.

Stellite round tool bits are used on turning or boring operations, or can be ground into drills or reamers. They possess the same red hardness, edge strength, toughness, and abrasion resistance as Stellite square and rectangular tool bits. Tool bits of 98M2

Cast Bronze Bearings *for* Long Life

● When you design your new product for tomorrow's market it will pay you to investigate the advisability of using CAST BRONZE bearings.

You gain several distinct advantages in cast bronze. In the first place few bearings deliver the smooth, quiet, efficient performance for so long a time as cast bronze. Properly designed and installed, they will usually outlast the motive unit in which they are used. The initial cost is comparatively low, they are easy to get and easy to replace.

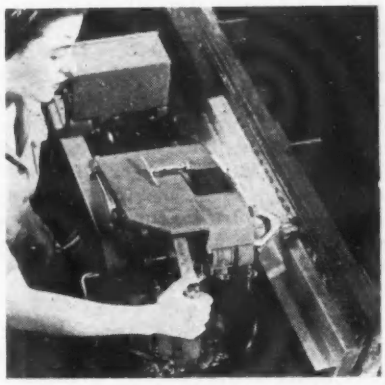
It is not a difficult matter to build this kind of service into your product. Simply call in a Johnson Sales Engineer. Permit him to review your applications, to make recommendations based on facts, free from prejudice. Our more than thirty-five years of exclusive bearing experience plus the fact that we produce ALL types of sleeve bearings enables us to give you the correct answers to your bearing problems. There is a Johnson Sales Engineer as near as your telephone . . . ready and willing to serve you.

JOHNSON SLEEVE BEARING HEADQUARTERS
The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD
625 S. MILL STREET NEW CASTLE, PA.

are made for faster machining of steel; Star J-Metal has long been used for machining cast iron, malleable iron, bronze, brass, aluminum, and some steels.

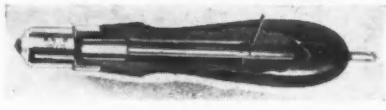
ARNHAM MANUFACTURING COMPANY, Buffalo, N. Y., is manufacturing a line of high speed carriage drills for production drilling of aluminum alloy spars, wing panels, and other long assemblies. The units are furnished complete, ready for installation on rails fastened to an assembly fixture. The addition of rails is all that is necessary to make an existing assembly fixture suitable for machine drilling. A variety of carriage mountings is available, both horizontal and vertical. For curved surfaces, such as wing panels, a carriage unit is available which is automatically controlled by a cam, keeping drill perpendicular to contour of work as carriage travels on straight track.

The drill feed, drill depth and return stroke are entirely automatic. After the drill unit is manually located in the jig hole, and thumb button depressed, the balance of the cycle proceeds automatically. The drill spindle is belt driven by a standard cycle ½-hp motor. Spindle speeds up to 10,000 rpm are available. Holes up to ⅜ in. diameter can be drilled.



Farnham carriage mounted drill

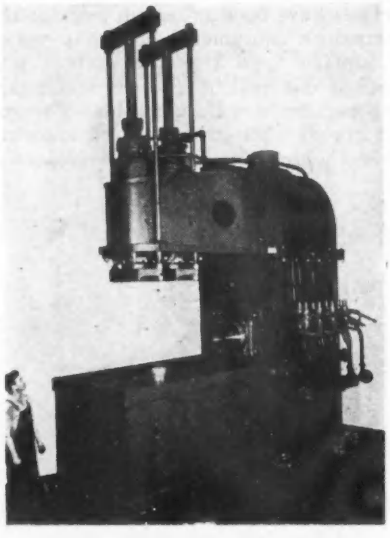
DIAMOND TOOL CO. NOT INC. Chicago, Ill., has designed a special handle, named the "Handl-Nib," for use in connection with the Company 7/16-in. shank Big-Hed-Nib diamond dresser. Tapping on the ejector rod in the handle removes the nib from the Handl-Nib holder. The same Big-Hed-Nib may be used for machine or hand tool dressing.



Handl-Nib diamond dresser holder

A HYDRAULIC sectional flanging press designed for 1500 psi working pressure has been recently completed by the R. D. Wood Co., Philadelphia, Pa.

Enclosed within the three piece welded steel plate frame are two 10-in. tension columns which carry the full stress



Wood flanging press

compact design . . . low weight with a BLACK & DECKER MOTOR

Your new product can be given these important advantages by using a Black & Decker motor because:

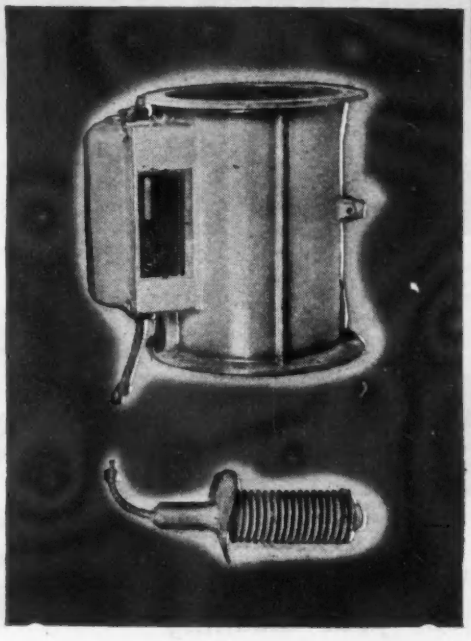
1. Every motor is designed to meet the requirements of a particular application.
2. Long experience has taught us where and how much *motor* weight can be reduced without interfering with essential electrical characteristics.
3. As a result of this experience, frequently product design suggestions can be made which reduce *product* weight . . . improve compactness . . . better performance.

In order to realize the full benefits of special application, be sure to consider the motor in the *early* stages of product development.

THE BLACK & DECKER ELECTRIC CO. • KENT, OHIO

Black & Decker
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS

AUTOMATIC "RED FLANNELS"



Fulton Sylphon Aircraft Temperature Regulator No. 707. The Fulton Sylphon Company manufactures a complete line of bellows and bellows assemblies for a wide variety of applications in many different fields. This wide practical experience is at your disposal.

FROM 90 in the shade to well below zero in 20 minutes . . . such are often the temperature changes encountered by our bomber crews. Clothing alone can't successfully combat conditions like these, and assure the split-second teamwork required for precision bombing.

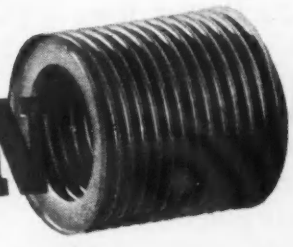
Air, heated by engine exhaust, warms the flight deck and bombardier's compartment. But there again sudden temperature changes defy conventional heating systems. A Fulton Sylphon Aircraft Temperature Control Device solves the problem by automatically proportioning the mixture of hot and cold air admitted—to maintain a constant, comfortable temperature.

For over 40 years Fulton Sylphon Control Devices and bellows assemblies have been doing big jobs and little ones—vitally important tasks and others not so critical. Bulletin MB-822 describes Fulton Sylphon applications in the aircraft field.

ARMY E NAVY

TEMPERATURE CONTROLS...

FULTON SYLPHON



BELLOWS . . . BELLOWS ASSEMBLIES SINCE 1904

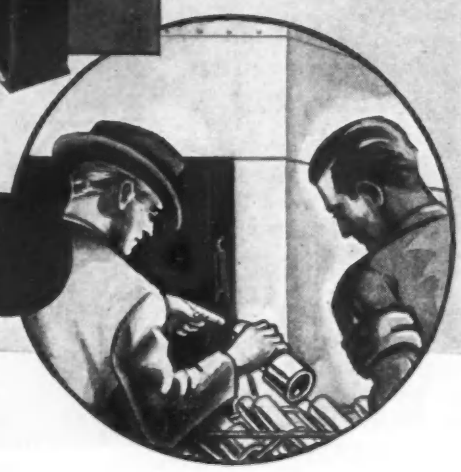
THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Bros., Montreal

EVERY DETREX DEGREASER SPRAY WASHER and PROCESSING MACHINE

Is Carefully Engineered for the Cleaning and Finishing Job for Which It Is to Be Used.

Is Built to Provide Long, Trouble-Free Service.



Is Guaranteed to Give Continuous, Efficient Performance.

With Detrex on the job, your cleaning equipment is backed with many years of experience by a most responsible company. You receive continuous "follow-through" by Detrex service engineers for the entire life of the equipment.

May we send you full information on Detrex machines and cleaning chemicals?

DETREX CORPORATION

13001 HILLVIEW AVENUE • DETROIT 27, MICHIGAN

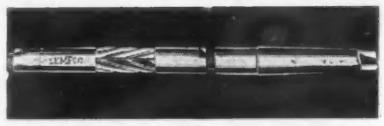
YOUR PURCHASE OF WAR BONDS SAVES LIVES

of the working load. There are two 16¾-in. diameter vertical main rams; a 14-in. stripper ram and a 15½-in. double acting horizontal ram. The travel of the main rams is 30 in. and each has a capacity of 150 tons. All operating valves are arranged in pulpit form. This arrangement will permit operating each of the two vertical main rams separately or both rams together, thus giving a total capacity of 300 tons.

The stroke of both the horizontal ram and the stripper ram is 24 in. and the capacity 115 tons. Maximum daylight opening is 45 in. Width of table, 8 ft. The table has four tee slots, machined from the solid, running from front to back, and is machined for insertion of stripper cylinder.

THE MODEL R hi-speed steel expansion reamer, made by Lempco Products Co., Bedford, Ohio, employs an adjusting lock nut to hold the three cutting blade segments rigid and to prevent any possibility of an oversize bore resulting even when the reamer blades are subjected to excessive pressures.

The Lempco Dual-Spiral reamer has



Lempco model R expansion reamer

three blade segments two of which spiral in a direction opposite to that of the third. This opposite-spiralling effects a shearing action which is said to finish-ream mirror-smooth any machinable metal, ferrous or non-ferrous, as well as laminated phenol-formaldehyde and other fibrous plastics ordinarily difficult to machine smoothly.

Extensions, pilots, and taper bushings are available for line reaming. Nos. 1 to 5 Morse Taper Shanks available, also butt shank type available for Turret lathes.

FOUR standard end bases, each supporting a LeMaire twin ram hydraulic unit, have been bolted to a special center base to form a LeMaire four-way universal machine developed by LeMaire Tool & Mfg. Co., Dearborn, Mich., for hollow milling and facing universal joint spiders.

The piece to be machined is laid on center fixture where it is automatically locked and held by air clamps while four spindles operating at stations 90 deg apart machine the outside diameter and face shoulders of the four trunnions of the spider. The spindles are arranged with infinite speeds to machine various diameters. Each spindle has a sleeve which rides on precision ball bearings. This sleeve is supported in brackets and held stationary while spindle revolves inside of it.

Pressing the control button activates all four spindles and they rapid ad-

A TWIST OF YOUR FINGERS— MAKES A TON-TIGHT* SEAL

LOSS of tire air pressure, means extra tire wear, and added cost to your customers. But you can help cut this loss, and keep their cars rolling, by applying a Sealing Valve Cap to every tire serviced.

Schrader Sealing Valve Caps screwed down finger-tight, are designed to maintain a positive seal. This seal keeps air pressure in and keeps dirt out. Vibration will not loosen the cap. It will not work off.

To help conserve your customers' valuable rubber do these three things:

First: Make sure every tire you service is equipped with a Schrader Sealing Valve Cap.

Second: Whenever you check tire pressures, *replace* the Valve Caps.

Third: Tell your customers why you are applying Schrader Valve Caps. It means dollars saved in additional tire mileage and prevents hours of roadside delay.

*When a Schrader Sealing Valve Cap is tightened with full finger strength, a downward force of about 50 pounds is exerted against the top of the valve mouth. The actual effective contact surface between cap washer and valve mouth is about 1/40 of a square inch. Multiplying 50 pounds by 40 gives the equivalent per-square-inch pressure—2,000 pounds.

SCHRADER FEATURES

1. Valve Cap body or shell.
2. Brass Swivel Plate allows Cap Shell to turn independently of rubber washer as Cap is applied. This assures proper seating of washer and prevents distortion.
3. Brass Dome-Shaped Plate provides an indestructible chamber for safe clearance of valve core pin.
4. Molded Rubber Washer seals valve mouth when Cap is screwed on firmly by hand; while rubber between brass plates 2 and 3 provides spring action to maintain positive seal.

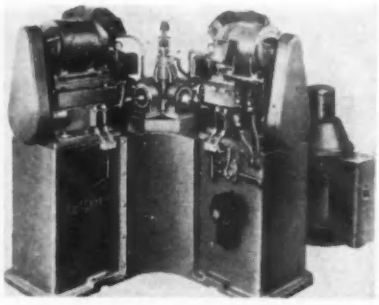
Schrader
REG U.S. PAT. OFF.
CONTROLS THE AIR

ARMY E NAVY

SCHRADER TIRE VALVE CAPS

Guaranteed Air-Tight Up to 250 Pounds Pressure

A. SCHRADER'S SON, ***Division of Scovill Manufacturing Company, Incorporated,*** **BROOKLYN, NEW YORK**

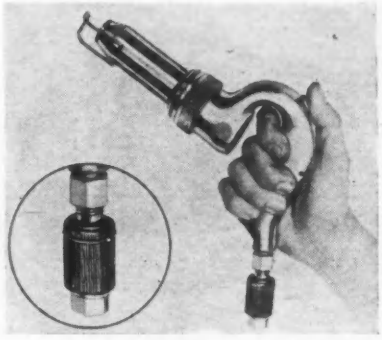


Le Maire four-way universal machine

vance simultaneously, followed by feed, dwell, and rapid return, all automatically. Production varies according to sizes of spiders machined.

The same type machine can be arranged for boring, drilling, reaming, etc. In many cases threading operations can be done in same setup.

THE Adjustable Flow Regulator, a new type control valve for use in connection with pneumatic tools and other devices, for regulating the volume of air or fluid flowing from supply line to tool or for use as a shut-off valve, is now in production at the Burklyn Company, Los Angeles, Cal.



Adjustable Flow Regulator

Rotation of the outside knurled sleeve provides flow control or regulation. Clockwise rotation opens the valve and counter-clockwise rotation closes it. Eight adjustment points are provided for one revolution of the regulating sleeve. Each adjustment increases or decreases the opening .004 in. Use of the device makes fine working speed adjustments possible on 1500-13,000 rpm air drills, or on rivet hammers. The regulator may also be attached directly to a supply line carrying air, water, oil or gas, and will hold up to 1500 psi pressure without leaking.

Typical of ELECTRIX Precision . . .
No, these are not bullets . . . they're the master gages that check the gages that check the bullets! One is a standard; the others, maximum and minimum . . . the differences between the three are so minute they are perfect examples of the extraordinary precision with which we work. If you need Gages and Special Tools where precision is an important consideration, write us your requirements — TODAY!
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ELECTRIX Corporation
Peacetime engineers of soft-rubber connectors for electrically-operated equipment, sold exclusively through U. S. RUBBER CO.
144 Middle Street, Pawtucket, R. I.

Leadership

(*Continued from page* 15)

could be asked in another way. How would he rank among the men who wrote our constitution?

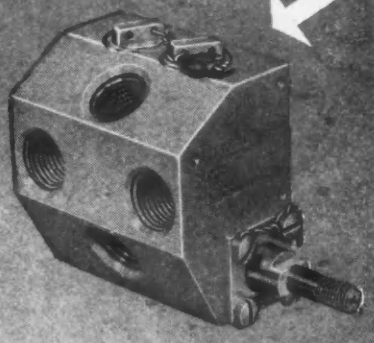
If there is anything wrong with America in the days near at hand, it may be too late to ask whether it is due to the shortcomings of our pseudo-statesmen who place principle after momentary political expediency or to our own shortcomings in having elected them and kept them in office.

Truly constructive leadership, based on sound economics and, even more importantly, on the fundamental principles of Americanism, is offered us today not by political statesmen but by industrial statesmen, by outstanding representatives of a group which our current politicians have done their best, or worst, to smear, by men, intelligent and well informed men, by intellectually honest men who really understand what has made America great. These new and hope-reviving leaders believe with unshakable conviction and preach with the confidence of practical experience that individual liberty and individual initiative are the seed and root from which our greatness grew. They see clearly a truth to which our political demagogues are blind. They see that the paths onto which we have been tempted by utopian political promises are the paths which lead inextricably to totalitarian domination by the State.

May the power and persuasiveness of our enlightened industrial statesmen ever increase.

This name OUTSIDE means QUALITY inside

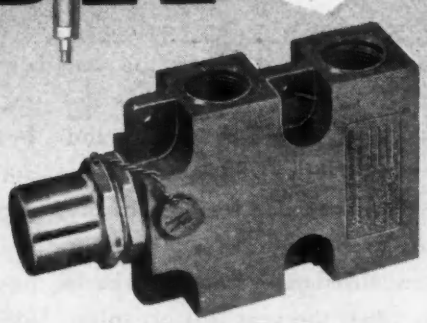
D 10150 4-way Selector AN 6210 "Mighty Midget" Weight 0.7 lb. Measures 1½" x 2¼" x 2¼". Cap. 3.5 GPM.



Unprecedented, pyramiding demand for ADEL hydraulic valves and acceptance of ADEL designs as Army-Navy Standards (ample proof of quality) has caused opportunists to offer untried substitutes—momentarily cashing in by copying the appearance but omitting necessary quality materials, skill and precision know-how. ★ The ADEL Customer Service Department is now getting calls for service on imitations, and service is being given although not ADEL's responsibility. Please remember, even ADEL valves sometimes require servicing which ADEL service engineers furnish together with installation, maintenance and general customer liaison work. They are instructed to service whatever equipment needs attention, but their first duty, naturally, is to ADEL products. ★ Some imitations are being sold as "licensed." Before buying we suggest you check at our expense regarding licensees. To make sure of ADEL *performance* and ADEL dependability, we say, "Look for the ADEL name which identifies genuine ADEL products!"

D 10590 "Stacking Midget" Wt. per unit .64 lb. Space savings of 72% and weight savings of 76% may be obtained by stacking small-size high-capacity valves for multiple control installations.

ADEL



ADEL PRECISION PRODUCTS CORP.
BURBANK, CALIFORNIA, HUNTINGTON 17, WEST VIRGINIA
OFFICES: DAYTON, DETROIT 2, HAGERSTOWN, SEATTLE 1

FOR WAR (AND PEACE) BUY BONDS

D 11800 ADEL Relief Valve AN 6200-8AB=1000-2100 psi Range @ 6 gal. Standard of the industry for maximum performance, top quality. Wt. 1.10 lb. Measures 2 13/16" x 5/16" x 1 3/16".

Aircraft Heating Systems

(*Continued from page 35*)

onally, its diameter being about one-third that of the latter. As compared with other exhaust-gas heat exchangers, the overall heat transfer factor is nearly the same, but the heat-transfer area of the single tube is smaller.

In the third type, the extended primary-surface heat exchanger, there is only a thin piece of metal between the hot exhaust gases and the air to be heated, and this heater therefore is quite efficient. While the design is somewhat complicated, the heat-transfer area per unit of volume is large, and the weight for a certain heating capacity low.

The heat exchanger shown in Fig. 2 is of the muff type, consisting of a metal cylinder surrounding the exhaust pipe to form an annular space through which the ventilating air flows. The forward end of the exchanger is rigidly secured to the nacelle, while the rear end is allowed to move freely. A ball joint in the exhaust pipe prevents the transmission of engine movements to the heat exchanger. Ventilating air is admitted to the annulus through a flared tube. At the rear the annulus is enlarged to form a collector ring to which the supply duct is attached. The whole exchanger is thermally insulated and provided with a metal shield over the insulation.

The airplane shown in Fig. 2 has a long exhaust pipe on the outboard side of each nacelle. In making a design study for a muff, the resistance to heat flow was found to be higher on the exhaust-gas side than on the air side, and the exhaust pipe therefore was reduced in size until both resistances were approximately equal.

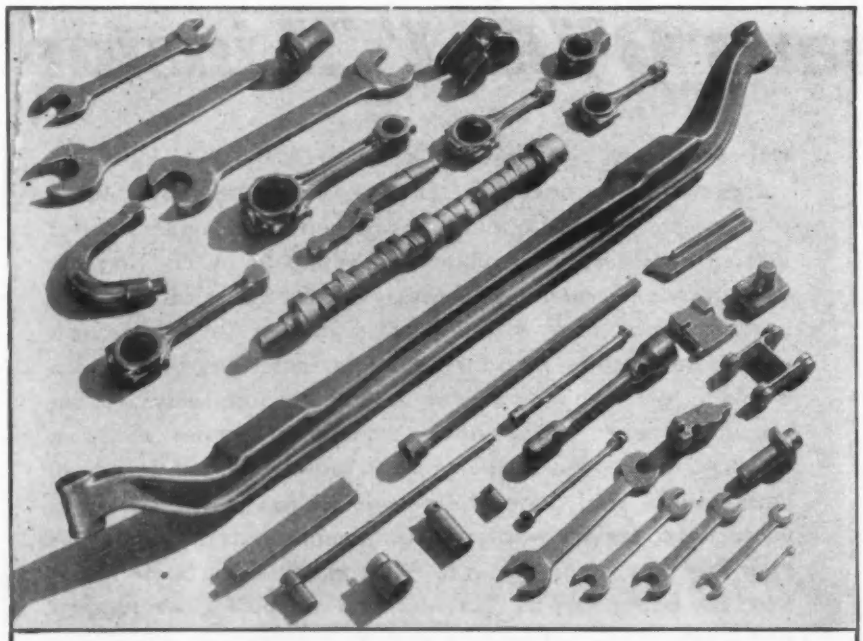
The fifth type of heat exchanger, the tube bundle, consists of a number of tubes welded together, with spaces between. Some designs have the exhaust gases pass across the tubes, while in others they pass through them. If either the exhaust gas or the air must make a turn before entering the exchanger, the one making the turn should pass across the tubes, as that will give better temperature distribution. The tube bundle has a good service life, and its ratio of heat output to weight is high.

The ducts that carry the hot air from the heat exchangers to the mixing valves are generally irregular in shape, changing from a square to a round cross section, or vice versa. Turns in the ducts are often sharp, and must be vaned to prevent excessive pressure drop.

Whether or not insulation must be used on the ducts depends on the loss of heat by convection, conduction, and radiation. If used, the insulation preferably should be light, of low thermal conductivity, fire-resistant, and resilient, the latter to prevent it from being crushed while it is being handled. Unfortunately an insulating material meeting all of these requirements has not yet been found.

The mixing valve assembly consists of three butterfly valves—one for hot air, one for cold air, and the third for discharging the excess hot air overboard. These three valves are interconnected. For instance, when maximum heat is desired, the cold air valve is closed, the hot air valve is opened, and the dump valve is closed. When no heat is needed, the cold air valve is opened, the hot air valve is closed, and the dump valve is opened, releasing the hot air overboard. Any intermediate position of the valves allows a portion of the hot air to enter the mixing chamber, the remainder being discharged overboard.

The tempered air is piped from the mixing chamber into the cabin air distribution system, which diffuses the air into the cabin. When outside air temperatures range from 0 F to 32 F, the cockpit mixing valve furnishes hot air for deicing the windshield without influencing the temperatures in other



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are treated in automatic electric controlled furnaces where exact regulation assures positive results

You men who are designing and building products for war needs or planning post-war developments will find Herbrand exceptionally well qualified to supply precision forgings of any size or shape up to 200 lbs. Our specialized experience dates back to 1881, the year this organization was founded.

Herbrand forgings possess an enduring, inbuilt stamina because they are scientifically heat treated by definite processes in the latest automatic electrically controlled furnaces where constant temperatures and exact regulation give positive results. You are assured forgings free from defects . . . Your inquiries are solicited.

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PENNSALT CLEANER EC-10

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This new organic type cleaner employs a new money-saving principle. It actually removes soil which alkaline cleaners won't budge in the short time present high production schedules allow. Drawing, polishing and buffing compounds as well as lubricants and cutting oils are removed in a single operation. It is particularly effective as a precleaner before electroplating.

Put Pennsalt EC-10 to work for you. For further information write our Special Chemicals Division. Address Dept. AA.

PENNSALT EC-10 was designed for two types of cleaning:

1. DIP CLEANING: Removes deposits by first saturating the soil, which is then burst off by the surface emulsion action of the rinsing operation. When rinsed and dried, parts are ready for painting or—with an added alkaline dip and rinse—ready for plating. Eliminates hand-scrubbing, keeps excess oils from contaminating alkaline cleaners, inhibits rusting between operations and drastically reduces cleaning time.

2. SPRAY WASHING: Can be used in conjunction with water in a spray power-washer or pressure gun. A very small quantity of EC-10, when added to water, forms an effective spray cleaning medium.

WHITEMARSH RESEARCH LABORATORIES

In our new Research and Development Laboratories near Philadelphia one group of chemists and engineers will devote its entire activities to new and improved products and processes for the metal finishing and allied industries.

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SPECIAL CHEMICALS DIVISION PRODUCTS: Orthosil® and other Sodium Silicates • Pennsalt Cleaners—acid, alkali and organic types • Pennsalt Strippers • Pennsalt Cements—acid and alkali-proof (Asplit, Causplit, Penchlor)® • Pennsalt LF-42—lead plating solution • Pennsalt FB-42—fluoboric acid—electroplaters' grade • Pennsalt Fluoride Fluxes • Pennsalt PM-40—acid pickling inhibitor • Pennpaint—acid-proof paint

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parts of the fuselage. This valve assembly consists of two butterfly valves, one in the hot-air duct and the other in the duct from the main cold-air supply.

The direct exhaust hot-air system should have some kind of carbon monoxide detecting equipment, since a crack or opening in the heat exchanger would let exhaust gas into the heating air stream. A heavier but safer exhaust hot-air type of heating system has been developed which passes the hot air from the exhaust heat exchanger through another exchanger, heating a second source of outside air for cabin distribution. Its primary air then may be released overboard, or used for empennage deicing.

Internal-Combustion Heater

A heater which burns fuel is known as an internal-combustion heater. Two types are in current use, one burning a "primary," the other a "secondary" mixture. Schematic installation diagrams of the two are shown in Figs. 3 and 4. Being independent of the exhaust, combustion heaters can be located close to the cabin distribution system, whereby piping is eliminated, weight saved, and heat conserved.

The first (primary mixture) type of heater ordinarily receives its mixture from the carburetor of the airplane engine. However, the mixture can be obtained also from an auxiliary gasoline engine, or from a motor-driven compressor combined with a carburetor, or it may be formed by letting the dynamic pressure due to the velocity of the plane force air through the heater carburetor. Primary-mixture heaters burn with a blue flame. Combustion is confined to a small space, which makes it difficult to transfer the heat efficiently to the ventilating air. An extended-fin combustion chamber is required to prevent the metal of the combustion chamber walls reaching excessive temperatures, and this adds to the manufacturing cost.

The primary type shown in Fig. 3 receives its mixture from the diffuser case of the engine supercharger. The products of combustion are returned through ducts to the intake of the engine supercharger, which supplies the pressure differential necessary to force the gas through the heater. Ignition is effected by a resistance coil in the combustion chamber. Ventilating air supplied by a scoop on the outside of the fuselage passes over the heat exchanger and, when heated, is conveyed to a ceiling distribution system in the main cabin and crew's compartment, where it is forced toward the floor at high velocity. Footwarmer outlets supply heat to the cockpit.

The rate at which heat is generated depends on the rate at which mixture is allowed to enter the heater, which is controlled by a butterfly valve in the supply line. An electric motor with manual override controls the heaters. The motor is automatically controlled by an amplifier receiving its signals from a cold-air supply, a hot-air discharge, and a cabin resistance-type thermostatic bulb.

The primary-mixture type of heater often fails to operate because the mixture it receives is either too rich or too lean. For high engine power the carburetor supplies a maximum-rich mixture, and it is difficult to design a fitting that will take from the supercharger blower case a mixture of the same quality as that received by the engine cylinders. Usually the heater under these conditions receives too rich a mixture. For cruising the engine is supplied by the carburetor with a lean mixture, and if the outside air temperature happens to be below 0 F, and the mixture-supply line to the heater long, part of the fuel will condense, and the mixture will be too lean. Besides, on some planes the lines returning the products of combustion to the engine become clogged with ice at very low temperatures.

The Douglas company is replacing primary-mixture heaters with the secondary-mixture heater shown in Fig. 4. In this, liquid fuel from the airplane-engine fuel pumps is sprayed into a cylindrical combustion chamber in an

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DOUBLE LOCKING ACTION!
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B
1. When the Palnut is tightened on top of regular nut, its arched, slotted spring steel jaws close in and grip the root of the bolt thread all around like the jaws of a chuck.
2. At the same time, powerful spring tension is exerted upward on the bolt thread and downward on the regular nut.
3. These forces combined, form the Palnut double locking action that prevents nut from loosening and bolt from backing out.

The unfailing double locking action of PALNUTS has proved itself for over 15 years on every type of equipment, under the severest vibration. PALNUTS are single thread, tempered spring steel locknuts, extremely low in cost, light in weight, quickly applied on top of regular nut with hand or power drivers. Require only 3 bolt threads space, withstand high temperatures, may be re-used. Full range of standard sizes. Write for samples and copy of Palnut Manual No. 1.

TYPICAL AUTOMOTIVE USES:

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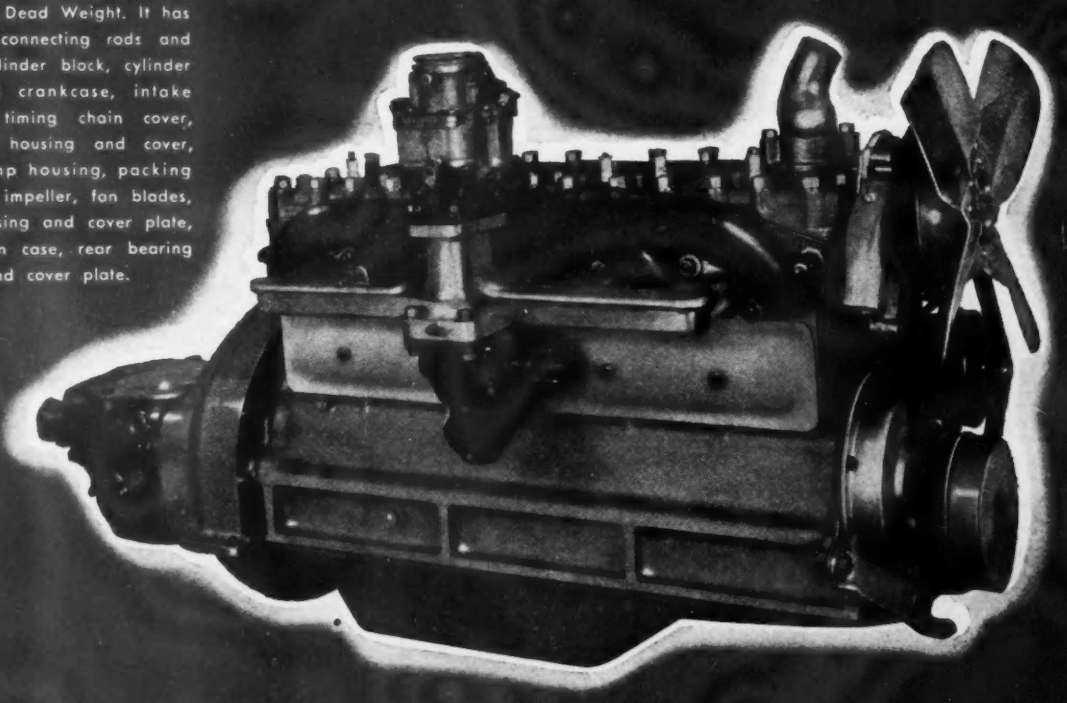
DOUBLE-LOCKING **PALNUTS**

HERE'S AN *Aluminum Engine!*

This "All-Aluminum Engine" Saves 175 lb. of Dead Weight. It has aluminum connecting rods and pistons, cylinder block, cylinder head and crankcase, intake manifold, timing chain cover, oil pump housing and cover, water pump housing, packing plate and impeller, fan blades, clutch housing and cover plate, transmission case, rear bearing retainer and cover plate.



No postwar dream, this aluminum engine, but a full-size working engine. Having spent hundreds of hours on the test block, it's now in an automobile for road test.

Both airplane and Diesel engines have long employed strong, lightweight aluminum alloys to reduce their pounds-per-horsepower. So there's a wealth of experience pointing to the satisfactory performance of lighter weight engines.

The engine we have pictured above is just one example of Alcoa's long-continued research on automotive and aviation applications. The "low-down" on performance and design from our laboratories and test floors, plus war-taught know-how on fabrication, are all available to you, as you pursue the problem of achieving lightness in your engines.

Cutting weight with Alcoa Aluminum is something to start now. We'd like to help. ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Pa.

ALCOA
ALUMINUM

axial direction, and air from an external scoop is introduced tangentially into the chamber. Owing to the dynamic pressure head, a constant pressure difference is maintained across the heater, and with a constant external pressure, a constant weight flow of air is assured. Up to 20,000 ft, the change in weight flow is not sufficient to affect the efficiency of the heater materially. At higher altitudes an altitude compensator is required, which so increases the pressure difference as to maintain the weight flow constant. The mixture is ignited either by an electric coil or by a spark plug. Where a spark plug is used, when starting the heater at temperatures below 0 F, the fuel must be preheated electrically before entering the combustion chamber. The secondary-mixture heater burns with a yellow flame, which gradually turns blue as the combustion progresses down the combustion chamber. The heat is spread over a large area, which makes an extended-fin combustion chamber unnecessary.

This heater can be governed by either a modulating or an "on-and-off" control on the fuel supply. Modulating control varies the rate of fuel supply between 100 and 30 per cent of the heater capacity, and is generally provided where temperatures are to be manually controlled. The "on-and-off" type goes together with automatic control. The fuel may flow through either one of two solenoid valves. One of the valves, when open, permits enough fuel to enter the heater for full capacity, while the other has a restrictor in it which limits the fuel to 75 per cent of full capacity. The automatic control opens or closes either of these valves, depending on the setting of the selector switch. It is similar to that used with the primary-mixture heater, except that the amplifier is smaller and that there is no electric motor. In the event of failure of the automatic control, it can be bypassed electrically by means of a manually-operated switch.

Ventilating air is supplied and distributed in the same way as for the heaters using a primary mixture, except that an additional small heater supplies heat to the cockpit for windshield deicing and for the pilot's and copilot's footwarmers.

Safety swtiches prevent the heaters from being operated when there is insufficient air for combustion or ventilating purposes; they also shut off the fuel at its source if the fuel supply line should leak or break. Carbon monoxide cannot enter the heated air, because the average pressure on the ventilation side of the heater is higher than that on the combustion side.

With the low pressure drops required for operating the secondary air-fuel type of combustion heaters, a small power centrifugal blower, electrically driven, can be installed as part of the airplane heating equipment. This arrangement makes it possible to heat the airplane on the ground independently of the main engines, on airplanes having space for an auxiliary generator set. This additional unit can be used also to supply electric power for starting the main engines and for hoisting cargo.

In a ground test, the secondary-mixture type heater, running at full capacity for 1000 hr, was in good condition at the end. Under flight conditions the heater would not be operating continually at full capacity, which justifies the assumption that its life would be considerably longer. The length of life of this heater compares favorably with that of other airplane equipment.

BULLSEYES are few... when blindfolded!

VISCO-METER* is the one device that tells just what the lubricating oil is doing at all times when an internal combustion engine is running. All other methods are guesswork in varying degrees...similar to a gunner trying for Bullseyes while blindfolded. VISCO-METER* shows when oil has "outworn" its usefulness and is too thin to protect against friction. It tells when to drain the crankcase and fill with fresh lubricant or build up a safe viscosity by adding heavier oil. By following this procedure, the engine gets every minute of wear safely out of every quart of oil. Oil waste is minimized. Lubrication failures are safeguarded. It is one effective method of prolonging the life of essential internal combustion engine parts.

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Davis Sales and Advertising Director at Ford Motor Co.

J. R. Davis, formerly western regional manager, has been appointed director of sales and advertising by the Ford Motor Co. Davis joined Ford in 1919. He was assistant sales manager from 1927 to 1937, general sales manager from 1937 to 1941, and western regional manager at Long Beach, Cal., since 1941.

Gagemakers GUARD Against Costly Scrap

and FACILITATE ACCURATE WORKMANSHIP

Visual Gage and precision grinder in a modern gagemaking plant.

Beside each precision grinder in many gagemaking plants, a Sheffield Visual Gage guards against costly scrap loss and helps operators turn out highly accurate work. *The Visual is the most widely used instrument by which gages are checked.* Sheffield appreciates this trust and is vigilantly mindful of the obligation it involves.

Hundreds of production plants also use Visuals at their precision grinders to help reduce scrap and obtain a higher rate of accurate production. *The Visual is recognized throughout industry as the authority on PRECISION.*

DELIVERIES WITHIN TWO WEEKS can now be made on Sheffield Visual Gages of six different amplifications—500, 1000, 2000, 5000, 10,000, and 20,000 to one. WIRE OR WRITE.

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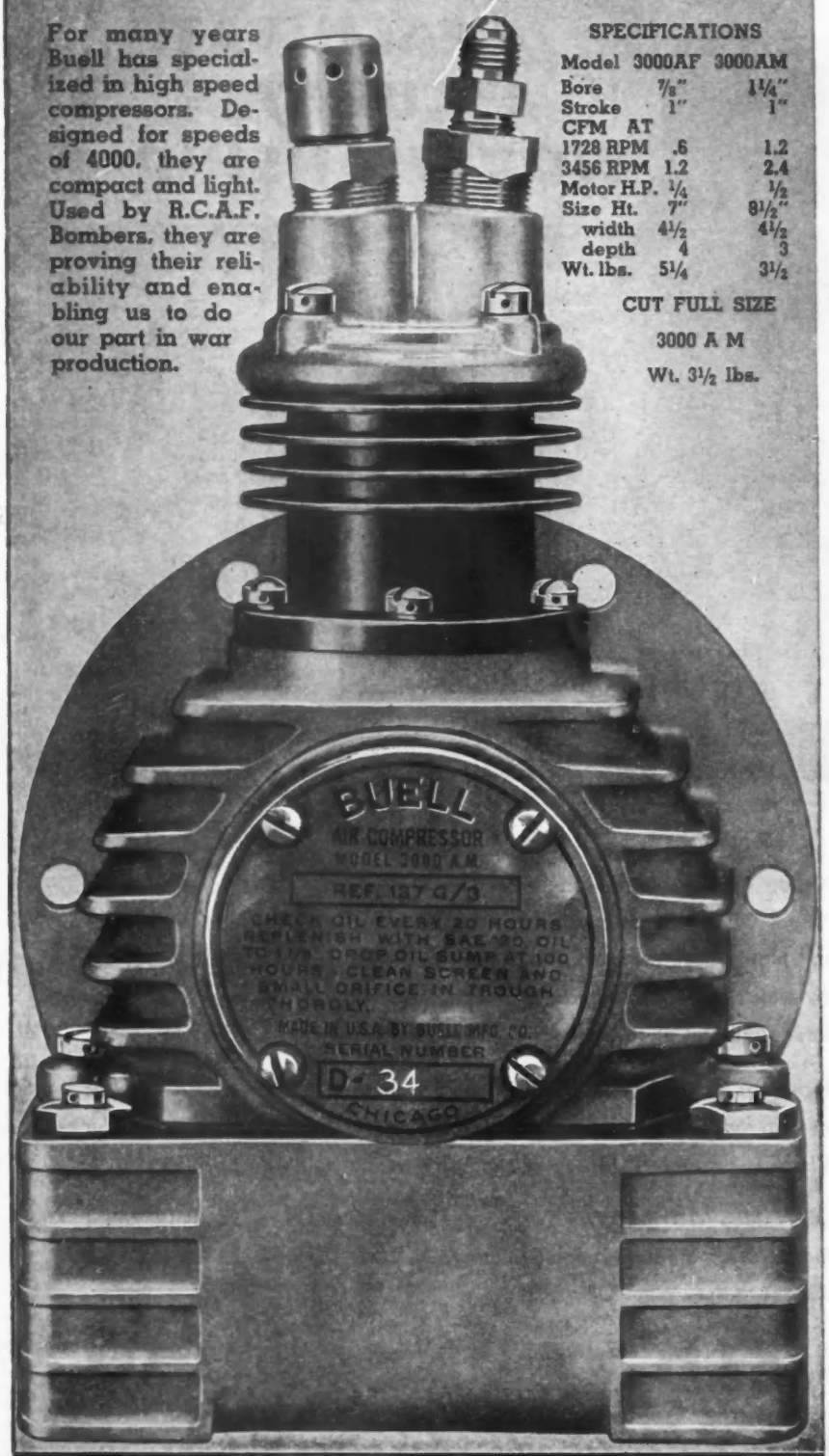
A precision built product with high alloy forged steel crankshaft, hardened and ground to close tolerances.

For many years Buell has specialized in high speed compressors. Designed for speeds of 4000, they are compact and light. Used by R.C.A.F. Bombers, they are proving their reliability and enabling us to do our part in war production.



SPECIFICATIONS

Model	3000AF	3000AM
Bore	7/8"	1 1/4"
Stroke	1"	1"
CFM AT		
1728 RPM	.6	1.2
3456 RPM	1.2	2.4
Motor H.P.	1/4	1/2
Size Ht.	7"	8 1/2"
width	4 1/2	4 1/2
depth	4	3
Wt. lbs.	5 1/4	3 1/2

CUT FULL SIZE

3000 A M

Wt. 3 1/2 lbs.

BUELL MANUFACTURING CO.

Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

Unemployment Compensation

(*Continued from page* 17)

5. Disbursements are to be made at a rate in conformity with the maximum and minimum established by State or Federal governments for unemployment compensation, until.

(a) a job of comparable skill and compensation as last held shall be made available to each person entitled to these benefits, or

(b) until such time as the total benefits accruing to each individual employe are completely disbursed, or

(c) until other employment is obtained by each person entitled to these benefits.

6. At the end of two years after complete settlement of all terminated war contracts, all withheld funds not disbursed by the companies operating under this plan shall be paid to the federal government.

In addition to the foregoing, and because it bears a definite relationship to the problems inherent in reconversion, the following recommendation is made:

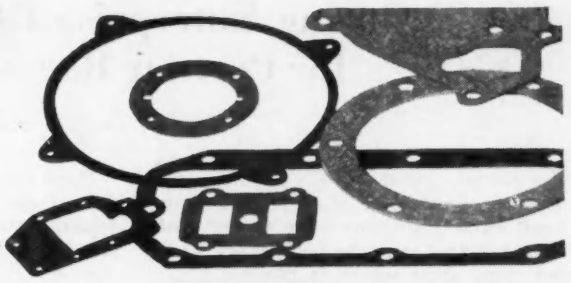
The Government shall appoint a joint board of labor leaders and qualified business experts to examine at once the present inventories of materials, commodities, semi- and finished goods and production facilities in the possession or control of each claimant agency and to recommend to the Government immediate steps to readjust any production program, either up or down, where it is shown that threatening surpluses are clearly indicated. Such information can, if deemed advisable, be kept confidential. However, the admission by Government officials of a minimum of $50,000,000,000 surplus of raw materials and finished goods which will be on hand at the end of the war makes it evident that planning in advance of the time when such a condition can wreck whole industries must be started at once.

Unless some such action as the foregoing is undertaken at once, there can be no assurance that the period of reconversion will not find either the National or State governments faced with mountainous unemployment compensation expenditures — expenditures so heavy in some instances that the financial structure of certain states may be imperiled.

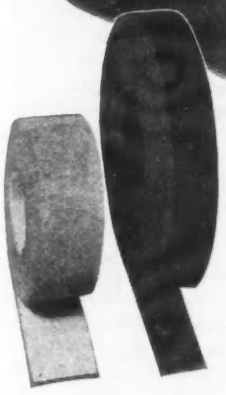
If, however, the remedy is attempted by means of added national taxation to implement present state unemployment compensation funds, the termination of contracts will find industry saddled with a continuing and intolerable burden. This plan provides a definite termination point for the accumulation of reserves for this use.

This formula is presented as being equitable to all companies, large and small, and to the employes thereof, who have converted, in whole or in part, their normal production for peace to that of production for war.

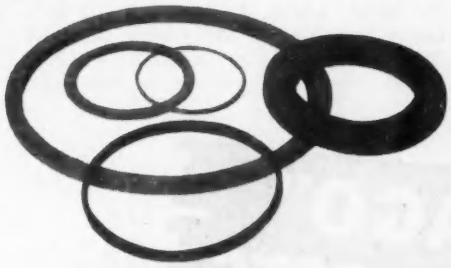
ROLL GOODS



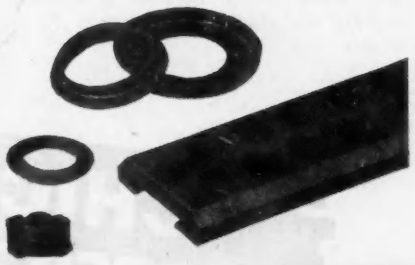
DIE-CUT PARTS



RIBBON AND TAPES

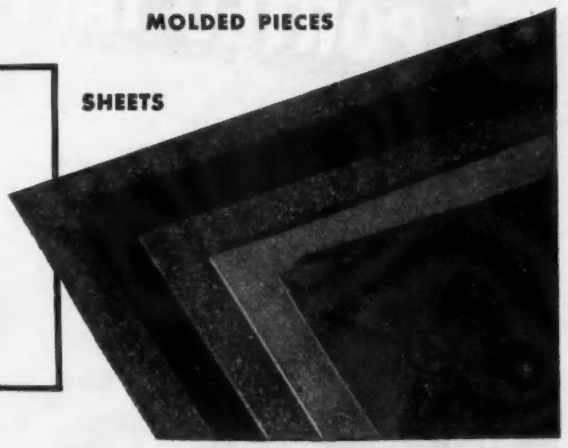


EXTRUDED RINGS



MOLDED PIECES

SEALING MATERIALS



SHEETS

MORE than fifty specialized sealing materials—available in many forms—each with the right physical properties for a specific type of sealing job! This wide range of sealing products enables Armstrong to supply you with the right material for any sealing application where the temperature does not exceed 300° F.

The Armstrong Line includes cork compositions, compositions of cork and various synthetic rubbers, "straight" synthetic rubber compositions, cork-and-rubber compositions, fiber sheet packings, rag felt papers, and natural cork.

These materials are available in roll goods, ribbon, and tapes . . . in sheets and strips . . . and in die-cut parts, extruded rings, and molded pieces.

For a free, illustrated booklet—"Gaskets, Packings, and Seals"—write Armstrong Cork Company, Industrial Division, 1506 Arch St., Lancaster, Pennsylvania.

ARMSTRONG CORK COMPANY

MATERIALS AND SPECIALTIES FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, anti-skid flooring, and gaskets
- **Tank strap cushions**
- **Sealing materials** for specialized aircraft equipment handling aromatic fuel
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties

Strong Enterprise Essential for Postwar Recovery

(*Continued from page* 20)

the trend. From 1900 to 1916 the amount of income coming from government each year was 5 to 6 per cent. World War I sent the percentage to 10 per cent, after which it receded somewhat, but for the greatest part of the Twenties it was between 8 and 9 per cent. Then in the Thirties it advanced rapidly and fluctuated between 17 and 20 per cent.

Here we have the paradoxical situation of the national economy becoming dependent upon governmental support, yet as disclosed in Fig. 4, it is necessary for government to absorb more and more of the Total National Income Produced, which, as compiled for this chart, consists of the yearly total of income received by individuals (National Income), business savings and business taxes. Personal taxes already are a part of the income of individuals (National Income).

Fig. 4 shows that part of the Total National Income Produced, principally in the form of taxes, that is diverted into governmental channels. How the Federal government during the Thirties used the combination of taxation and the convenient age-old method of deficits to make huge expenditures, the principal device used by fascism to perpetuate itself, is shown clearly in this chart. In 1914 about 7 per cent of the Total National Income Produced went into governmental revenue. A Federal deficit was rare in the early years of this century. During the New Deal Thirties the amount of the TNIP absorbed by government rose 17 to 19 per cent and big deficits of $2.5 billions to $7.5 billions incurred each year by the Federal government. The deficits are charted in percentage of Total National Income Produced in Fig. 4.

The Thirties present an excellent example of the nation's economy under "government operation" with few tangible beneficial results. As of May 31, the Federal gross debt (direct and guaranteed) was $188 billions and authoritative estimates place it at $258 billions by the end of June, 1945. As at the end of World War I, retrenchment is necessary and certain to come.

Sources of Data

National Income (income of individuals)—1799-42, The Conference Board; 1943, U. S. Dept. of Commerce.

Federal Govt. Gross Debt (direct and guaranteed)—U. S. Treasury Dept.

State and Local Govt. Dept (outstanding interest-bearing securities)—The Conference Board.

Long-term private debt—The Conference Board.

Income from Government—The Conference Board.

Total National Income Produced—Compiled from U. S. Dept. of Commerce reports.

Federal Govt. Revenue—U. S. Dept. of Commerce.

State and Local Govt. Revenue—U. S. Dept. of Commerce.

"Chicago" Ported Valve Tappets are being used extensively in diesel and gasoline engine fields. Over years of service and under severe conditions these tappets have proved that they can "take it". . . In specifying valve tappets—there are many advantages to be gained by insisting upon "Chicago" Ported Valve Tappets. These quality products are made from a special grade of alloy cast iron, assuring uniform "clear chill" depth at the cam face . . . The "porting" feature of these tappets has a definite advantage in providing lubrication of tappet guide holes . . . Exacting inspection operations guarantee machining and grinding to the highest standards of quality . . . "Chicago" Ported Valve Tappets are made in a wide range of sizes to meet our customers' individual specifications.

ARMY E NAVY

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO, ILL.

Anderson Aluminum Forge Plant

(*Continued from page* 25)

Although at this writing the operation is new and has not had the benefit of continuous production experience, the management has demonstrated its ability to produce a variety of difficult aluminum forging jobs. Not the least of these has been the successful production of parts having thin webs, hitherto believed to be quite out of the range of a forging press. It should be of great interest to the industry to keep track of progress by way of demonstrating the utility of forging presses as contrasted with the time-honored methods of drop hammer forging.

New Bendix Branch Office

Eclipse-Pioneer Division of Bendix Aviation Corporation has opened a west coast branch office in Los Angeles, Cal.

"Captain Dag"

trace THIS FIGHTER'S RECORD BY HIS MEDALS!

If there were decorations for industrial heroes, Mr. Dag would be a much be-ribboned gentleman. Perhaps we should call him 'Captain' Dag, because he commands so versatile a company of physical and chemical properties.

Captain Dag (a campaigner who will never be mustered out) represents Dag brand colloidal graphite, the smooth, black liquid concentrate which serves so many different war industries. Capt. Dag may take the form of a dry film, a fluid film, a surface coating, an impregnation, etc.

1, 3, 8, 14, 13, 6

CITATION: "We have been enthusiastic users of Dag colloidal graphite for more than ten years. We find it the only material which will prevent bolts, nuts and flanges from seizing under the high temperature and pressure conditions in our boilers and steam systems."

1, 3, 13, 14

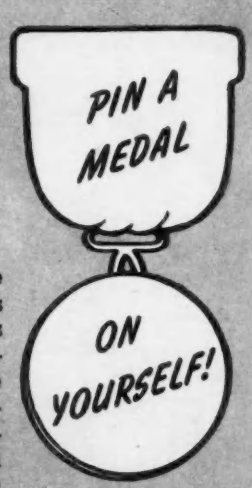
CITATION: "Dry films formed from Dag colloidal graphite supply durable lubrication on parts which could not be effectively lubricated otherwise. Such films are functioning at temperatures from (—60° F. to +1200° F.) and higher."

PHYSICAL AND CHEMICAL PROPERTIES

1. Slippery—A Good Lubricant. Softer than Talc
2. Conducts Electricity
3. Withstands Temperature Extremes
4. Absorbs, Radiates and Conducts Heat
5. Maximum Purity
6. Low Coefficient of Expansion
7. Particles Bear Like Electric Charges
8. Insoluble in Acids and Alkalies
9. Black and Opaque
10. Gas Adsorbent
11. Little Photoelectric Effect
12. Miscible with Most Fluids
13. Films Adhere Tenaciously and Dry with Sharp Edges
14. Microscopically Fine Particles. Penetrates Fine Pores
15. An Excellent Suspension

2, 4, 13, 10, 11, 3

CITATION: "Graphite films when applied to the grids (and frequently the plates) of radio tubes for receiving and transmitting, are useful for minimizing secondary emission, 'back' emission and photoelectric effects."



For easy reference we've given colors to Captain Dag's most valuable properties. Match these colors with the performance "citations" above. Then pin a medal on yourself for putting Captain Dag to work in your plant. He's one campaigner who won't be mustered out.

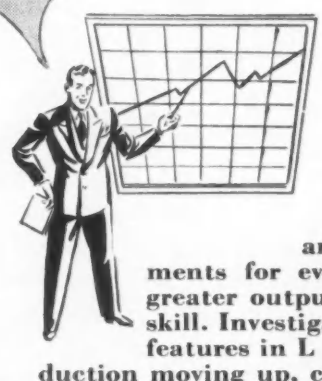
Dag, Oildag, Aquadag, Castordag, Glydag and Prodag are registered trade marks of Acheson Colloids Corporation. Copr. 1944 by Acheson Colloids Corp.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION

PORT HURON, MICHIGAN

"Costs are greater today though we're making the same pre-war products. With these new L&S Lathes our manufacturing costs are kept in line."



WAGES have always been a major factor in production costs. More recently, new forms of taxation—plus additional clerical and accounting expenses imposed by legislation—have added heavily to the burden on production. From all indications, these high costs will prevail long after the war's end. Therefore, to keep manufacturing costs low—now and later—greater output per worker must be obtained, new, more efficient machinery must be utilized.

No matter what products you're making now—whether they're new or prewar—it will pay you to learn about the economies you can effect with up-to-date L & S Lathes. Every element needed to obtain favorable production costs is available in these modern machines. Automatic devices and manufacturing attachments for every type of work assure greater output with far less operating skill. Investigate these and many other features in L & S Lathes. To keep production moving up, costs moving down, Lodge & Shipley Engineers are always at your service.

PREPARE FOR THE COMING BATTLE OF MARKETS!

Competitive conditions in your field may be greatly changed when the time comes for reconversion. But one thing is sure—high cost producers won't make the grade. For a better product, at lowest possible cost, be sure to use the newest developments in machine tool design. But don't wait until the day of re-conversion to plan. Call in Lodge & Shipley Engineers now to study your future lathe requirements.

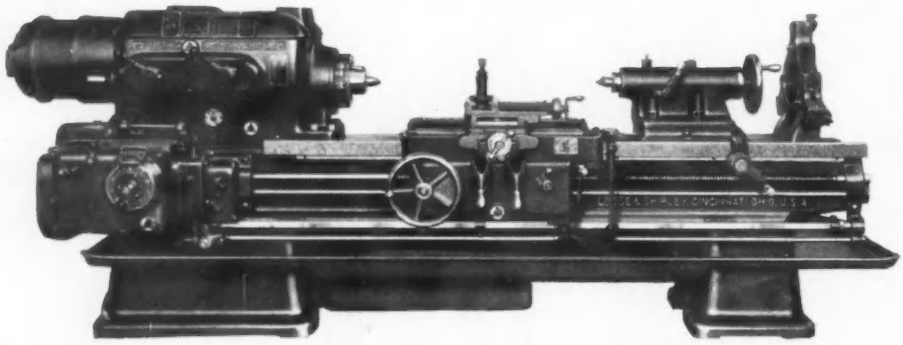


Illustration shows the 20" Selective Head Tool Room Lathe, designed to provide many years of highest quality precision work, and to furnish greater output at lower cost per piece. L & S Tool Room Lathes are available in a number of sizes to meet your special requirements. Write for Bulletin No. 508-BO.

ENGINE
AUTOMATIC
TOOL ROOM
OIL COUNTRY
LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

New Products for Aircraft

(*Continued from page* 72)

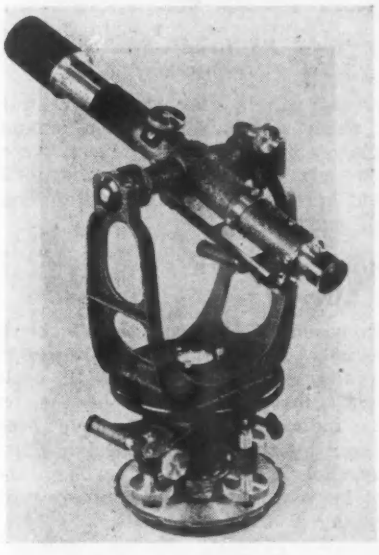
the bus. The XRP breaker does not trip because the reverse current is lower than its trip setting. When a fault occurs in the generator circuit, however, the reverse current may rise quickly to values far in excess of the interrupting ability of the generator relay. In such a case, the air circuit breaker instantly trips and clears the fault.

Since this breaker trips on reverse current only, it eliminates false tripping on faults in other parts of the system which draw forward current.

This 20-ounce breaker interrupts fault currents in less than 0.015 second, limiting fault damage and preventing damage to other equipment. It will operate in the wide range of temperature from —65 F to +160 F and will withstand 95 per cent humidity at 160 F on 48-hour test. In addition it will meet the 200-hour, salt-spray test, as specified by various government agencies.

Collimator Aids in Making Aircraft Jigs

An aircraft jig collimator has been put into production by C. L. Berger and Sons, Inc., Boston, Mass., for use in



Berger aircraft jig collimator

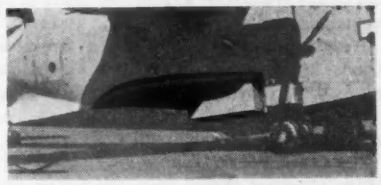
making master jigs and assembly jigs. The makers claim that the collimator can accomplish quite easily and more accurately the problems of jig construction and inspection than could be attained by the music wire methods of guiding.

When lines must be established with relation to the center-line of a complex jig, the collimator accomplishes the task by a process of "wiggling-in" the instrument on the center-line using the lateral adjuster on which the collimator rests.

Once a straight line is established with reference to the center-line and the cross wires of the instrument, other points on the jig may be located with reference to this extended center-line. By using the collimator the structure can be re-leveled, changed and checked if necessary, and inspected anywhere and at any time.

Droppable Fuel Tank Aids Plane Take-off

The development of a new droppable sponson fuel tank that can be used to increase the range of the PBM-3 Mariner by 60 per cent with no appreciable effect on performance characteristics

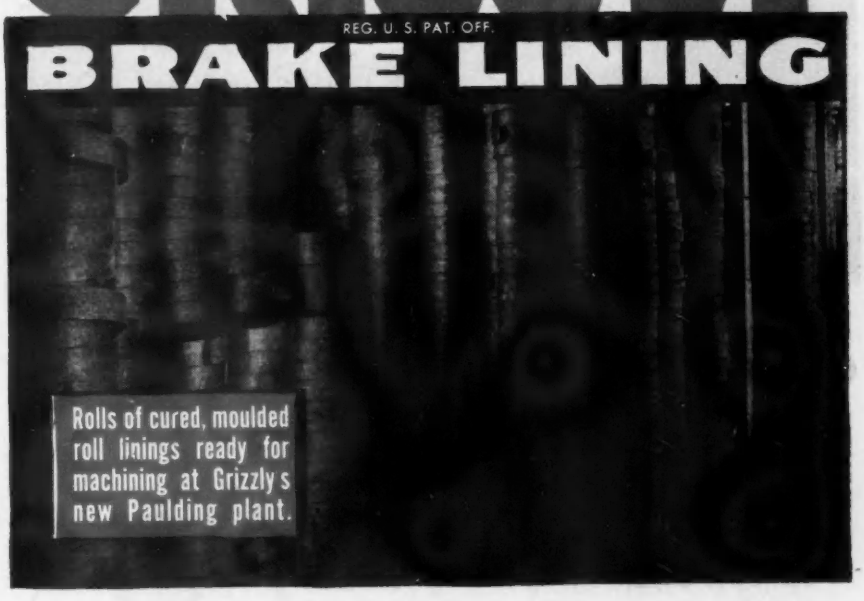


Pierson sponson tank

GRIZZLY

REG. U. S. PAT. OFF.

BRAKE LINING



You Should See

. . . the production technique responsible for Grizzly's vastly increased volume!

. . . the scientific processing and the precision machining responsible for Grizzly's outstanding quality!

You can see both — by writing for a copy of our book, "*Building* UP *To A Name*"—a live, photographic report of a development based on 28 years of "Stop Engineering."

"Building UP To A Name" will be sent to any one having a legitimate interest in brakes or brake linings. Address the Engineering Department at Paulding.

GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND LOS ANGELES
Warehouse Stocks in Principal Cities

other than a 2 per cent reduction in top speed, and that is easily adaptable to all types of flying boats, is announced by the Glenn L. Martin Company, Baltimore, Md. The new Martin device, called the Pierson sponson tank, is attached exteriorly along the chines in the vicinity of the main step. It is said to overcome one of the main limiting factors of former auxiliary gasoline tanks by providing added planing area to compensate for the weight of the additional fuel.

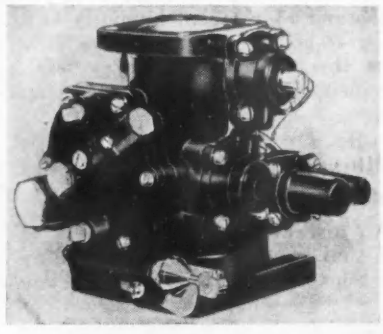
With the Pierson sponson tank, the added planing area provided by the bottoms of the tanks, themselves, compensates for increased load to such an extent that take-off characteristics for a given airplane are said to remain about the same as they would be without the sponsons and the added load they carry. What sacrifice in speed there is need not even be for the entire duration of the flight, since these tanks are droppable and can be jettisoned as soon as the fuel they contain is consumed.

Bendix-Stromberg Injection Carburetor

Now in production for use in Army helicopter engines, the new PS model of the Bendix-Stromberg injection carburetor is said to maintain the ice-free characteristics of larger injection carburetor types which equip the majority of Allied tactical aircraft.

Suitable for small airplane engines up to 200 hp., the new, smaller "PS" series of Stromberg injection carburetors is being produced for the Army Air Forces for use in helicopter engines. Incorporating basic design features called for in Army and Navy specifications for smaller aircraft, the "PS" carburetors will be ready for delivery to private plane engine builders after the war, it was stated by the Bendix Products division of Bendix Aviation Corporation.

The new smaller carburetors are single barrel units and can be adapted for use in any one of three positions; updraft, downdraft or horizontal, at the choice of the engine designer. All models are equipped with a vacuum

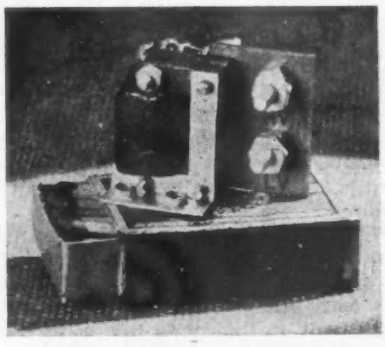


Model PS Bendix-Stromberg carburetor

operated, single diaphragm accelerating pump and a combination manual mixture control and idle cut-off. Automatic mixture control and additional power enrichment features are optional in all models.

Autotransformers for Aircraft

Two small size autotransformers, especially designed to furnish proper a-c voltage for operation of 400-cycle aircraft instruments such as the remote indicating compass, have been released by the General Electric Company, Schenectady, N. Y. They are light in weight, the 6 volt-ampere unit weighing 2 ounces and the 12 volt-



General Electric autotransformer

On the Land . . . and in the Air . . .

IT'S ARROW

Black-out headlamps, tail lamps and parking lamps, special mirrors and reflectors, all built by Arrow, are serving on Army vehicles on many fronts. Arrow formation lamps, dome lights and anchor lights are riding the clouds with many planes in the Air Forces. Here at home, thousands of vehicles vital to war production travel the highways of the Nation with Arrow lighting equipment.

Normally adequate facilities have been taxed to the utmost to meet the demand. It has been impossible not to disappoint many of our customers. But peace will come again. And when it does, Arrow will again be ready with the finest line of lighting equipment available. Just as Arrow took the lead in Sealed Beam headlamp conversions Arrow will again take the lead in post-war with other new and profitable lighting developments.

ARROW SAFETY DEVICE CO.
MT. HOLLY, N. J.

Air Power Through Piston Rings

McQUAY-NORRIS
ALTINIZED
PISTON RINGS

PISTONS...PINS...
HARDENED AND GROUND PARTS

More and more, the leading makers of aircraft motors are using McQuay-Norris precision parts. Our 34 years' experience in precision manufacture, our long and intensive work in metallurgy, heat treating, clinical research and laboratory experiment, enable us to turn out the sturdy, dependable parts demanded by modern aviation. Your inquiries are invited.

PARTS FOR AIRCRAFT ENGINES

Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY

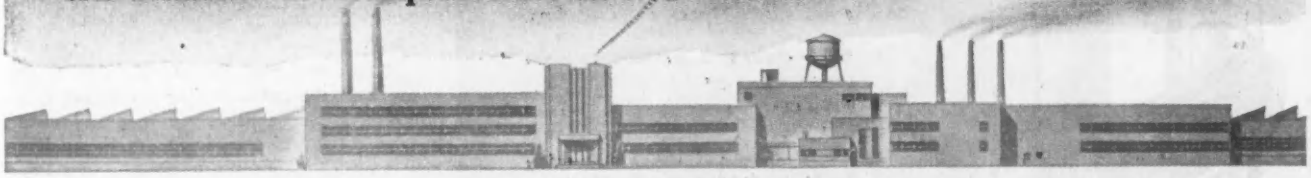
Machined Magnesium Parts
Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT

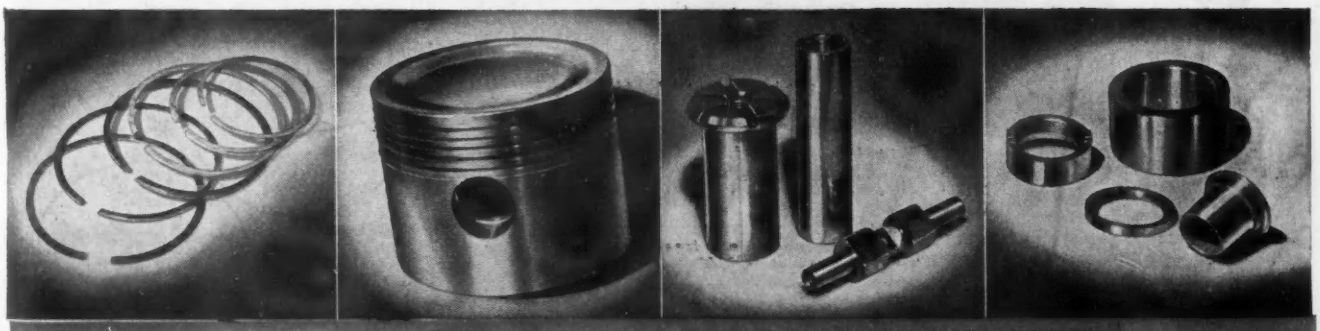
Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

LANDING GEAR PARTS

Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts



PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.
CANADIAN PLANT, TORONTO, ONTARIO

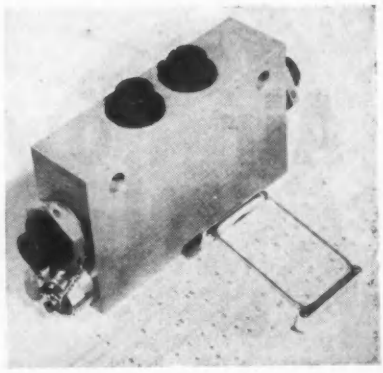
ampere unit weighing 3 ounces. The units are approximately 1¾ in. by 1¼ in by 11/16 in, and they both operate over a frequency range from 380 to 420 cycles.

These autotransformers can be applied on planes that have a 110-120 v, a-c power source available, thus eliminating the need for additional inverters to supply, from the d-c source, the correct a-c voltage for operation of these instruments. Their use allows more complete utilization of the available a-c power source.

With sufficient ventilation, the autotransformers will operate efficiently at any altitude. While rated at 120 volts input, they are suitable for operation over a voltage range from 110 to 130 volts.

Three New Small Size Hydraulic Lock Valves

Three new small size, light-weight, hydraulic lock valves are now in production at Adel Precision Products Corp., Burbank, Cal. Designed for installation aircraft to protect machine turrets, landing gear and other vital controls against operation failures due to leakage caused by combat action or other reasons, the new valves lock hydraulic fluid in cylinders or hydraulic motors until the directional control valve is operated, thus maintaining pressure in the actuating mechanism. Automatic in their operation they hydraulically lock the cylinder and are opened by pressure released by the selector valve.



Adel hydraulic lock valve

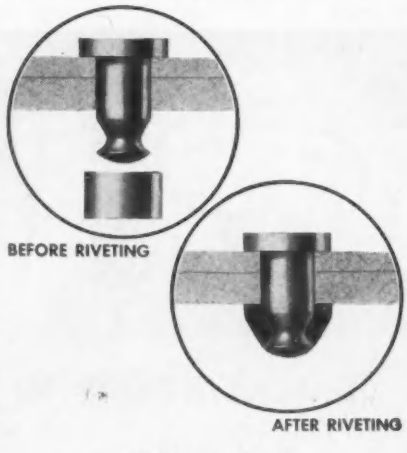
Critical operating parts are of corrosion-resistant steel. Bodies are of dural bar stock. A thermal relief valve is incorporated in each lock valve cylinder port to bleed off excess pressure at from 1200 to 2000 psi depending on requirements. Operation range is from —65 F. to 160 F. Type D12940, illustrated, weighs 1.18 lb, measures 4 in by 2 7/16 in by 1¼ in. Valves may be obtained for various tubing size installations.

STURTEVANT
QUALITY
Why be Satisfied with
LESS than Sturtevant Quality?
In any operation requiring the accurate control of torque on vital nuts, screws, bolts, hydraulic fittings —of all threaded parts—have the advantages of Sturtevant permanently accurate Torque Wrenches.
1. Clear faced dials — readable from any angle.
2. Permanent accuracy — Longer Life.
3. No friction, adjustments, moving parts or fragile mechanisms.
4. Practically indestructible.
5. Sturtevant pioneered design and quality throughout.
Because Sturtevant Torque Wrenches are PERMANENTLY accurate, the vast majority of torque wrench users standardize on "STURTEVANT".
Over 50 models and types from 0-10 inch ounces to 7200 inch pounds.
NO
FRICTION
ADJUSTMENTS
MOVING PARTS
FRAGILE
MECHANISMS
BUY
MORE
WAR
BONDS
STURTEVANT
QUALITY

Aircraft Rivets of Alloy Steel

Pheoll Manufacturing Company, Chicago, Ill., have been appointed prime licensee by North American Aviation, Inc., for the manufacture of the Hi-Shear rivets developed by that Company.

The rivet consists of two parts; the pin and the collar. The Hi-Shear rivet pin is made of alloy steel, heat treated to a minimum tensile strength of 125,000 psi, and cadmium plated. As such



Hi-Shear rivets

Helping the warbirds take a big bite—

Born of combat experience, the Navy's new Curtiss *Helldiver* is heir to all the improvements developed from battle crowded skies since Pearl Harbor. And one of the things that makes it a plane to write home about is its variable pitch propeller.

The intricate gear mechanism for these 3-bladed, full-feathering props is being built by the Detroit Gear Plant of Borg-Warner's Norge Division.

These propellers adjust to every change in altitude, wind resistance, engine speed.

The skillful engineering needed to produce gear mechanisms of such delicate sensitivity is another result of Borg-Warner's long-time principle: "design it better—make it better." More than 100 war items are today benefiting by it.

With the end of the war, this Borg-Warner principle will again be applied to the task of working with you in the automotive and aviation industries toward a better living for all America.

Partners with the automotive and aviation industries in peace and war, Borg-Warner supplies these and other essential parts . . .

CLUTCHES AND CLUTCH PARTS
GEARS
UNIVERSAL JOINTS AND DRIVE SHAFTS
TRANSMISSIONS CARBURETORS
TIMING CHAINS PUMPS
RADIATORS
AVIATION STEEL

ENGINEERING B-W PRODUCTION

BORG-WARNER

Peacetime makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . . these units which form the Borg-Warner Corporation are today devoted exclusively to the needs of war: BORG & BECK • BORG-WARNER INTERNATIONAL • BORG-WARNER SERVICE PARTS • CALUMET STEEL • DETROIT GEAR AIRCRAFT PARTS • DETROIT VAPOR STOVE • INGERSOLL STEEL & DISC • LONG MANUFACTURING • MARBON • MARVEL-SCHEBLER CARBURETER • McCULLOCH ENGINEERING • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS • WARNER GEAR

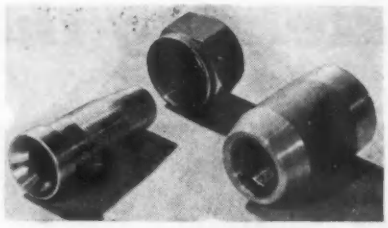
hard material cannot be squeezed or hammered down to form a head, a malleable collar is provided. This collar is made of A-17ST aluminum alloy, anodized.

Hi-Shear Rivet Pins are the same as comparable sizes, of AN hexagon head aircraft bolts in regard to material, heat treatment, finish and body diameter. The shear strength, therefore, is the same as that of the corresponding size standard aircraft bolt. Although Hi-Shears are installed with riveting equipment, they are essentially threadless bolts. This basic fact governs all strength considerations.

Detachable Hose Fitting

The Aeroquip detachable hose fitting, developed by the Aeroquip Corporation, Jackson, Mich., is used in all Army and Navy combat planes for hydraulic installations.

The male fitting consists of two pieces and a swivel type fitting of three pieces, each of which is replaceable individually. Assembly is accomplished by screwing nipple into socket. Once assembled no further tightening or servicing is necessary, although fitting can be easily removed from hose and roused repeatedly. Fitting is suitable for AN

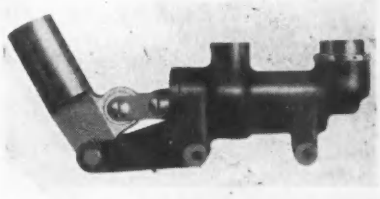


Aeroquip detachable hose fitting

Standard medium pressure (three braid) and medium-high pressure single wire braid hose.

Hand Operated Hydraulic Pump

Pesco Products Co., Cleveland, Ohio, has a new hand operated hydraulic pump, suitable for installations in which small quantities of fluid at high pressures are required. This unit, weighing 2.4 lb, has a rated capacity of ⅛ gpm at 20 cycles per minute with



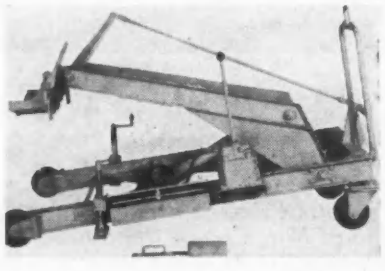
Pesco hand operated hydraulic pump

1500 psi discharge pressure. The fixed lever has a total movement of 57½ deg. Needle bearings at lever and pivot minimize operating torque. Spring-loaded ball check valves provide unidirectional flow of the fluid. Lubrication is by the fluid passing through the pump.

Universal Airplane Tail

To lift the tail wheel of a plane to flight level for checking instruments, Phillips Pump & Tank Co., Cincinnati, Ohio, has designed a Universal airplane tail and leveling jack which is adaptable to a wide number of uses. It has a maximum lift of 70 in.

As shown, this jack is designed to enter under the tire while resting on the ground, and offers the advantage of raising the plane from this point. Other types of adapters can be provided for a multiplicity of uses.



Airplane jack made by Phillips Pump & Tank Co.

CENTRAL *UNIVERSAL* HOSE CLAMPS IN *Action!*

• Army and Navy combat vehicles, farm and road-building machinery, diesel and gasoline engines, and all types of radiator hose are equipped and serviced with Central Universal Hose Clamps.

It's the clamp-power of Central *Universal* Hose Clamps that keeps the Army "Ducks" watertight and in action on land and water!

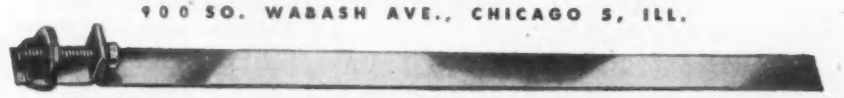
Made of extra-heavy rolled steel, the *Universal* is powerful enough to withstand abnormal pressure, stress and vibration. It is rustproof, leakproof, self-locking, 100% universal, and easy to use in hard-to-get-at places.

Standard for all service needs, it can be quickly installed or removed without disconnecting the line.

SEND FOR FREE SAMPLE

CENTRAL EQUIPMENT CO.

900 SO. WABASH AVE., CHICAGO 5, ILL.



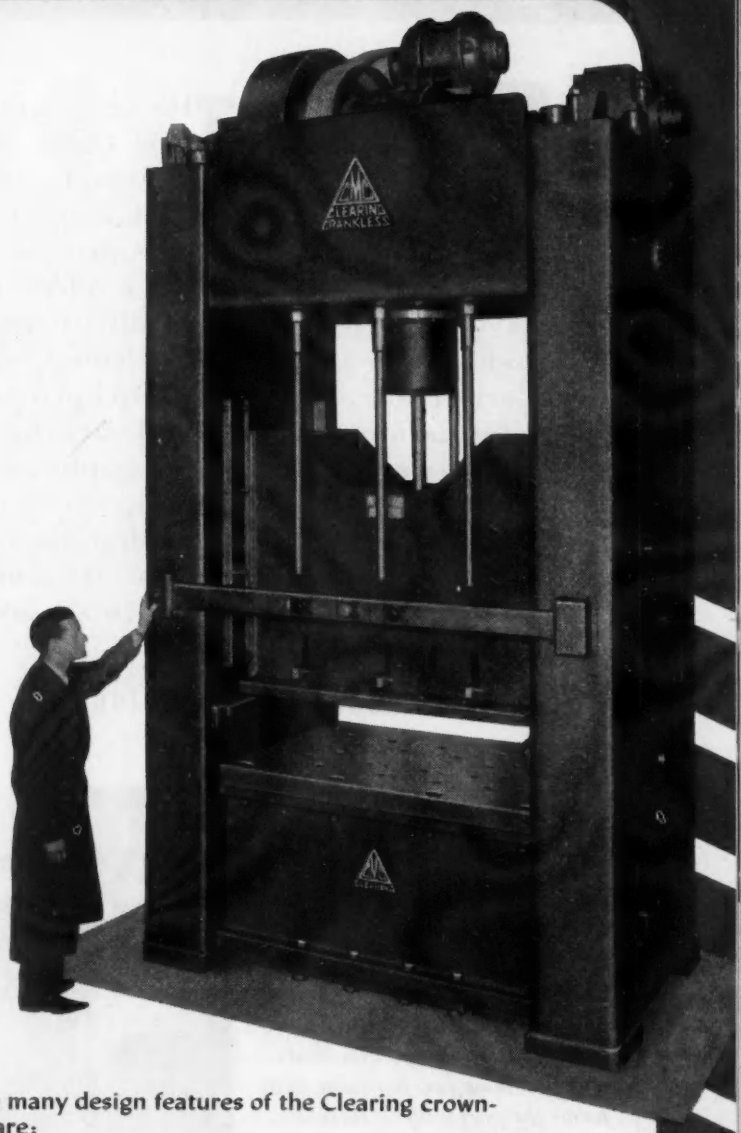
A SINGLE LENGTH UNIVERSAL CLAMP FITS HUNDREDS OF DIAMETER SIZES

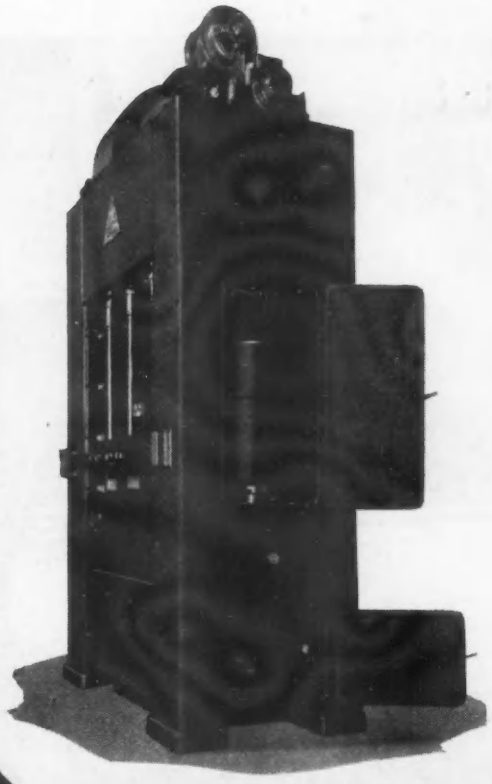
CLEARING CROWNLESS

The crownless, self-lubricating mechanical press illustrated here is another modern development in Clearing press design.

In this type of construction, an eccentric drive unit is housed in each of the two uprights of the press. All stress developed under ram pressure is absorbed entirely by the welded steel upright sections. The two eccentric drive units with steel herringbone gears provide symmetrical transmission of power to the slide at its extreme ends.

All parts of the press are built in. Eccentric drive assemblies, electric wiring, and air line piping are readily accessible by means of doors in the uprights.





Among the many design features of the Clearing crownless press are:

- Clearing oil bath system automatically lubricates all moving parts of the press. Gibs are automatically lubricated as well.
- Compact design saves floor space...no pit required ...installation can be made with minimum headroom.
- "Built-in" construction provides maximum safety for operators.
- The unusually deep slide is guided by extra long gibs which are precision machined to assure accuracy equal to the quality of the dies.

For complete information on this or any other type of mechanical or hydraulic press from 50 to 10,000 tons capacity, write Clearing today. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.

CLEARING

CMC CLEARING

MECHANICAL AND HYDRAULIC PRESSES

for such operations as

BLANKING • BEARING • FORMING • FORGING

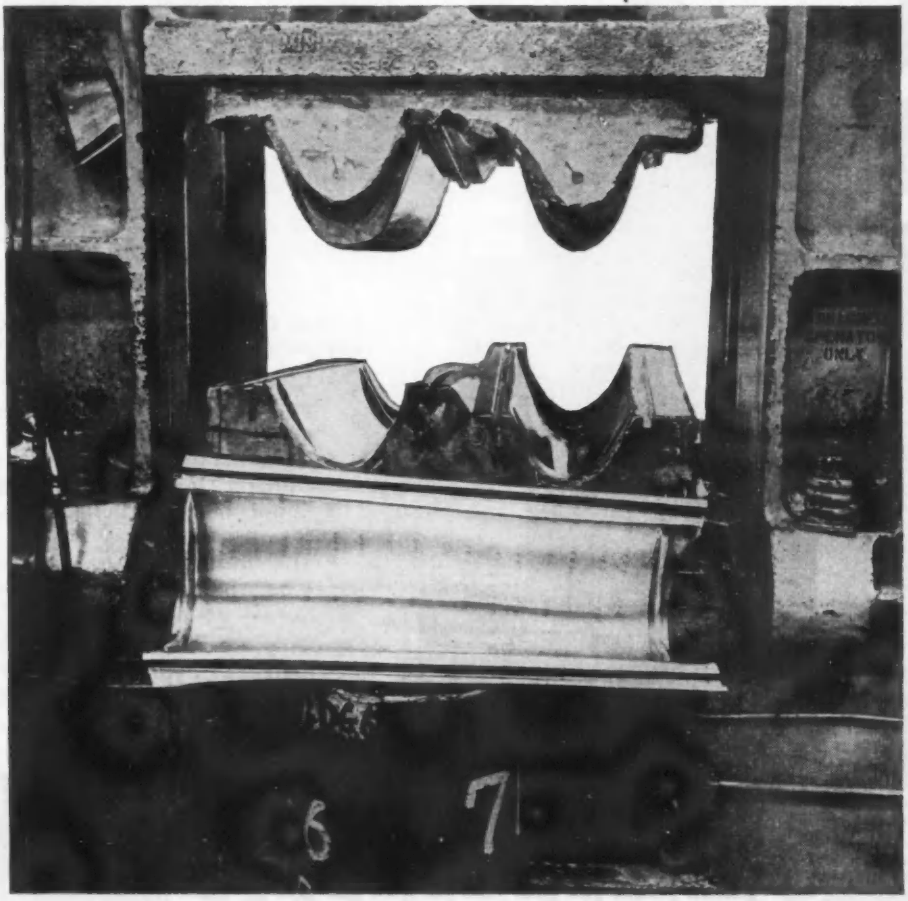
CHAMBERSBURG CECOSTAMP

THE Cecostamp continues to blaze new trails in the formation of the tough, springy sheets of light-weight, hard-to-form metals used in the production of aircraft and other modern equipment. Having the ability to produce even intricate shapes in sheet metal without tearing, wrinkling or stretching, the Cecostamp opens up new fields in the formation of sheet metal parts for use in the limitless post-war market. New applications are constantly being made by Cecostamp users, many of which have been photographed and described, and are now a part of our files. Perhaps you are working along similar lines. If you would like to see some recent developments, please write us.

CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PA.

DATA ON PHOTOGRAPH

This photograph shows an excellent example of multiple die work, utilizing the full bed area of a 48" x 48" Cecostamp. The die is accurately balanced; and the part, a 24SO Aluminum fairing, is made in two blows. The first blow is a hard one that forms the part without wrinkles. The second blow is a lighter one to combat any effects from air pressure confined in the trapped die. With this dual-impression die, the Cecostamp is actually forming one part per blow. Incidentally, this particular Cecostamp die has eliminated the necessity for a skilled operator and the need for rubber pads in forming this part.

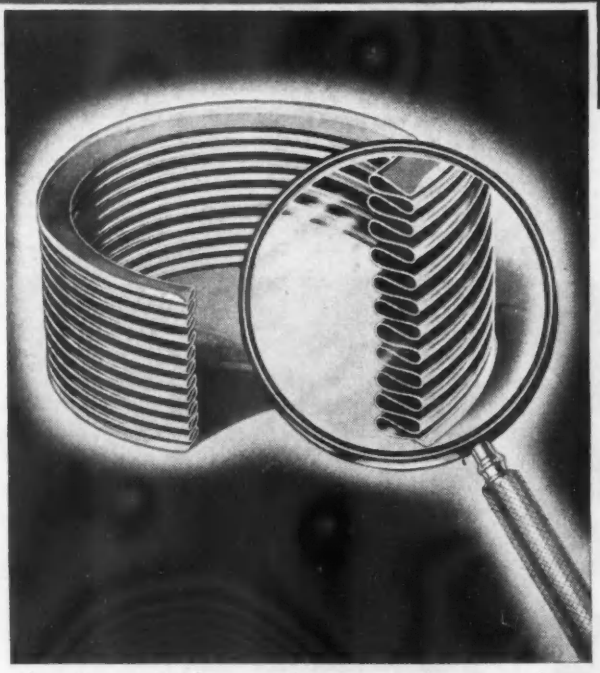


PRESSURE FREQUENCY STROKE CORROSION TEMPERATURE

BELLOWS

aren't sold by size alone

METAL FRICTION VIBRATION CONDITIONS STRESS

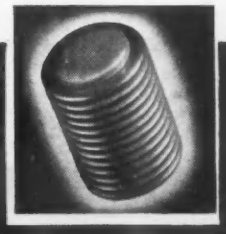


Showing a Bridgeport bellows in section—deep, springy folds or convolutions formed hydraulically —a seamless metal unit wisely used for hundreds of purposes.

BELLOWS—like keys—are simple things —but also like keys they can't be sold by size alone. A bellows correctly specified, is the result of many calculations based on the specific function of the bellows.

Before a certain bellows is recommended, many factors must be considered —pressure, temperature, movement, frequency of operation, corrosive agents, and others which have a definite bearing on the service life of the bellows.

But why worry with these things—our corps of experienced engineers are daily assisting customers and prospective customers with such problems—they have the "know how" that assures bellows "can do." Use the simple, convenient questionnaire in our new catalog No. MB-100. Write for a copy.



Bellows Assemblies . . . Bellows . . . Bellows Devices

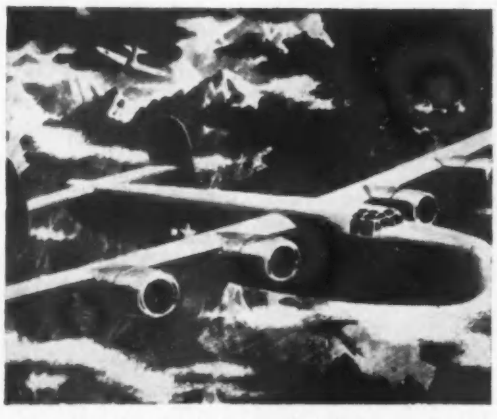
BRIDGEPORT THERMOSTAT COMPANY, INCORPORATED — BRIDGEPORT, CONNECTICUT

This advertisement is one of a series which is appearing in national magazines and newspapers as Consolidated Vultee's contribution toward a clearer public understanding of transportation's role in the war, and its postwar opportunities and responsibilities.

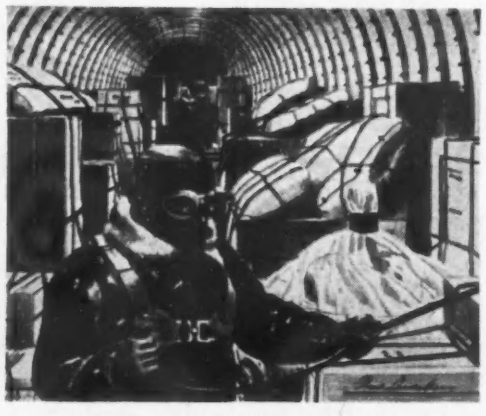
The Story of "The Hump"—the world's most dangerous overland air route

1. Today, American airmen are ferrying a greater tonnage of military supplies to hard-pressed China than was ever carried over the tortuous Burma Road. They're flying it over "The Hump"—the towering Himalayas between India and China. It's the most treacherous 500-mile air route in the world. *But the freight goes through!*

2. The first leg of the journey is over the steaming, foggy Assam jungles. Because there are no emergency landing fields, some of the planes have crashed. But most of the men who bail out eventually plod their way to safety, aided by rescue pilots, who drop written instructions, food, and medical supplies by parachute.



3. Day and night, the heavily loaded Liberator Express transport planes streak toward "The Hump." Shuttling across a tumbled mass of uncharted mountains, they dodge peaks that rise 20,000 feet. Icing is an ever-present hazard. Flying unarmed, the cargo planes are often attacked by Jap fighter planes. *Still the freight goes through!*



4. This slender aerial life line over "The Hump" is now the *only* channel by which Allied war equipment gets into China. Around the clock, in monsoon season and out, our flyers carry a constant stream of gasoline, bombs, jeeps, ammunition, artillery, small arms, clothing, aircraft engines and spare parts.

CONSOLIDATED VULTEE

5, Many of our India-China flyers have been awarded decorations—and they've earned them! No one pretends that the supplies being flown in are sufficient to fully equip the Chinese. But the same ingenuity and courage that can conquer the lofty Himalayas will eventually open up new channels of transportation so that today's trickle of supplies will swell to an avalanche.

6, After the war, when all forms of transportation must work together to rebuild the peacetime world, the plane will continue to play its part, along with the truck, the train, and the ship. But the plane will have a second, and even greater, responsibility to fulfill: *that of helping to enforce the peace in this 60-hour-wide world.*

In short, a permanent postwar Air Force can be one of America's soundest investments in the interests of a lasting peace.

Quick Facts for Air-Minded Readers

Preview of the future—Last year, 6% of the dollar volume of all imports to the U. S. came by air—a total of 4,000,000 pounds.

Many of the air cargoes included mica, quartz crystals, industrial diamonds, and rare drugs, without which the production of vital war materials could not have continued.

Saving American lives—Litters for 8 wounded men can be fitted into the bomb bay of a Liberator bomber. The Army has already flown out several hundred thousand casualties from combat areas to hospitals.

9 tons per month—The Air Service Command reports that for every Air Force pilot based overseas, it sends out an average of 9 tons of aviation supplies monthly.

This does not include food and other items which are handled by the Quartermaster Corps.

An airline is born—In order to expedite the flow of military personnel and equipment to the South Pacific, Consolidated Vultee operates a daily air-transport service known as Consairway.

A Liberator Express recently chalked up Consairway's 1000th transpacific flight.

Consolidated Vultee is the largest builder of airplanes in the world.

No spot on earth is more than 60 hours' flying time from your local airport

From "Flying Jeeps" to Leviathans of the air — *The planes shown below were all designed and developed by Consolidated Vultee. When peace comes, the company will be in a position to provide the postwar equivalent of such planes, from small, privately owned "air flivvers" to huge, transoceanic cargo-and-passenger planes.*

AIRCRAFT

San Diego, Calif. · Vultee Field, Calif. · Fairfield, Calif. · Tucson, Ariz. · Fort Worth, Texas · New Orleans, La. · Nashville, Tenn. · Louisville, Ky. · Wayne, Mich. · Dearborn, Mich. · Allentown, Pa. · Elizabeth City, N. C. · Miami, Fla.

Member, Aircraft War Production Council

R-301 the ALUMINUM ALLOY that has both STRENGTH and RESILIENCY

R-301, THE NEW REYNOLDS-DEVELOPED ALUMINUM ALLOY, combines high strength and resiliency for the first time. Elasticity and thermal conductivity, so vitally important in absorbing kinetic energy without fracture, are inherent properties of this latest Reynolds triumph of metallurgy.

Tests with armor-piercing shells have proven that *pound for pound* R-301 surpasses former armor metals . . . and that's why new fighting planes are protected with this latest Reynolds aluminum alloy.

R-301 is the first high-strength aluminum alloy that has a hard core as well as a tough surface cladding . . . with a corrosion resistance almost as good as 99.5% aluminum! The cladding is more homogeneous in relation to the core, and this adds still other important advantages—higher bearing, shear, yield and fatigue strengths.

R-301 is more workable than previous high-strength aluminum alloys. From the initial die stampings right down to the final fabrication, R-301 speeds production and cuts spoilage.

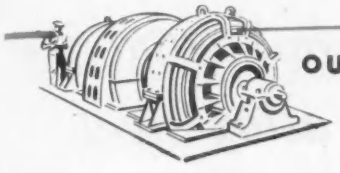
R-301 is being produced in three tempers, suitable for a wide range of structural and industrial applications. Write for full information. Reynolds Metals Co., Aluminum and Parts Div., Louisville, Ky.

R-301 is so tough it is used as armor on the new fighting planes. Pound for pound it surpasses former armor-plating metals.

R-301 being tested for hardness. It has a tough cladding as well as a strong core . . . and a corrosion resistance almost as good as 99.5% aluminum.

REYNOLDS METAL

REYNOLDS ALUMINUM



OUT OF THE STRATOSPHERE COMES AN ANSWER TO

Longer Commutator Life

FOR EARTH-SURFACE MACHINES

Little more than a year ago, generator failures on high altitude planes had become a critical problem—failures caused by extremely rapid brush wear at altitudes above 30,000 feet. Brushes which normally lasted hundreds of hours on earth-surface machines often gave out in 1½ hours' flying time.

To meet this critical problem, Westinghouse Research Engineers accelerated research studies begun even before this situation developed. These studies proved that the trouble was caused by loss of film on commutators in the thin, dry atmosphere—resulting in a "grindstone" effect between commutator and brushes, which literally ground the brushes to pieces.

By applying a special treatment to the brushes, it was found that the film on the commutator could be restored at a rate equal to that at which it was being destroyed.

Details of this treatment must remain secret. But here are two significant facts for every user of commutating machines:

1. Its success in improving commutation under the tough conditions of high altitude flying has led to its application to earth-surface machines.
2. It promises to have wide application where machines must operate in atmospheres contaminated by corrosive fumes or gases.

Tests have shown that through the use of this brush, commutator condition can be materially improved, regrinding greatly reduced and brush life lengthened.

We welcome inquiries on your commutation problems—and our engineers are available to assist with tests. Contact your nearest Westinghouse office or, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. J-90528

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

New and special heat-treating equipment now available at Pittsburgh...*has capacity to handle 25,000 tons of rolled alloy steel products annually*

THIS NEW HEAT-TREATING equipment places at the disposal of alloy steel users in the Eastern area the latest and most advanced mechanical and metallurgical developments in the fine art of annealing and heat treatment. It supplements the 158,400-ton annual capacity for producing electric furnace steel now in operation at our Duquesne Works, near Pittsburgh.

High, uniform quality is insured by a novel, 7-chamber, continuous furnace electrically heated and automatically controlled. It is used for production line service in heat treating bars which require quenching and drawing operations, normalizing or annealing, including special types of anneals such as sub-critical or by isothermal transformation.

So arranged that it may be operated in a continuous 366-ft. hardening and tempering line, this furnace will handle a *single layer* of 25-ft. bars, from ⅜ in. to 8¼ in. diameter, as well as flats or squares.

This method of single layer heat treatment of bars has definite advantages. Bars will be more uniformly heated, less scale is formed, overheating is avoided. Greater flexibility and closer control are also assured whenever a particular or special type of heat treatment is necessary.

For spheroidize annealing and for annealing operations requiring long controlled, slow-cooling cycles, three 25-ft. and two 36-ft. gas-fired car bottom furnaces are further available. Oil and water quench tanks are available for heat treating bars from these furnaces. The necessary auxiliary equipment is of the latest, most improved type.

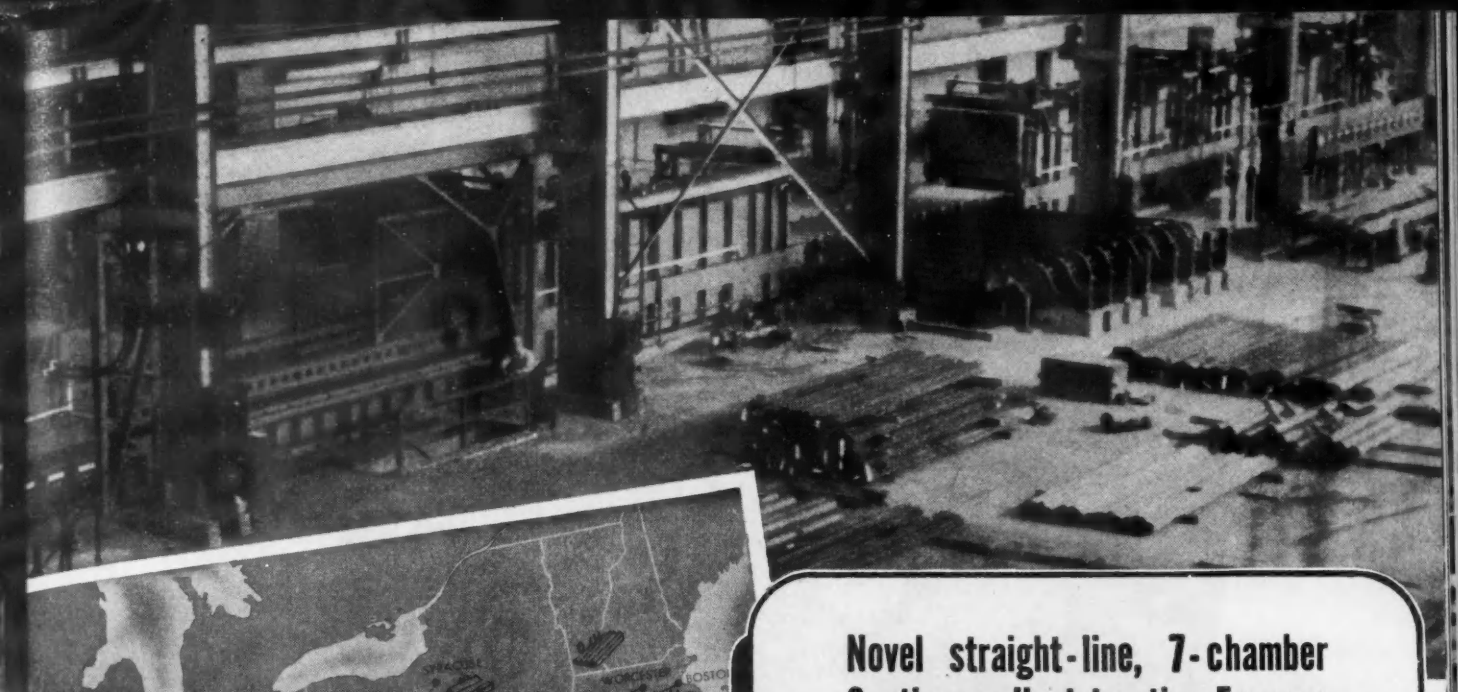
Designed to insure superior physical properties in the heat-treated product, this equipment provides the flexibility to handle small orders as well as full heats when necessary.

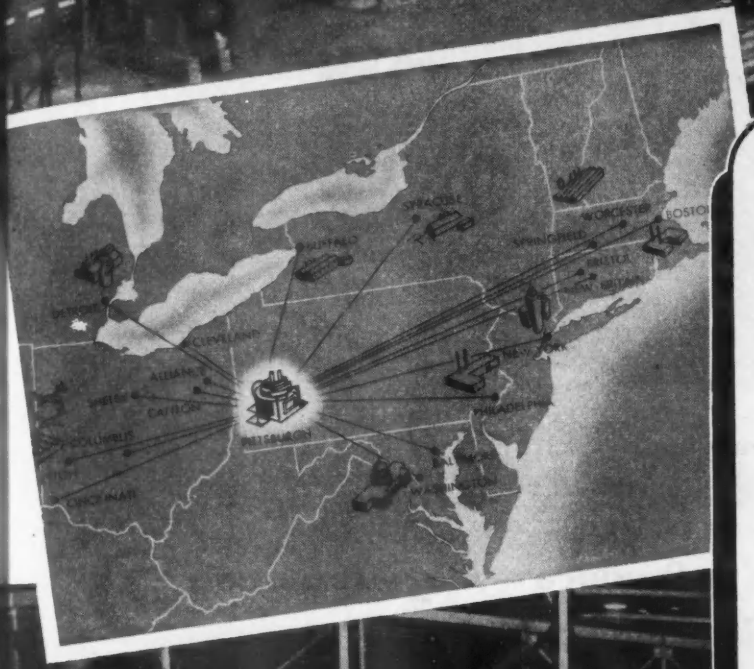
USS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York





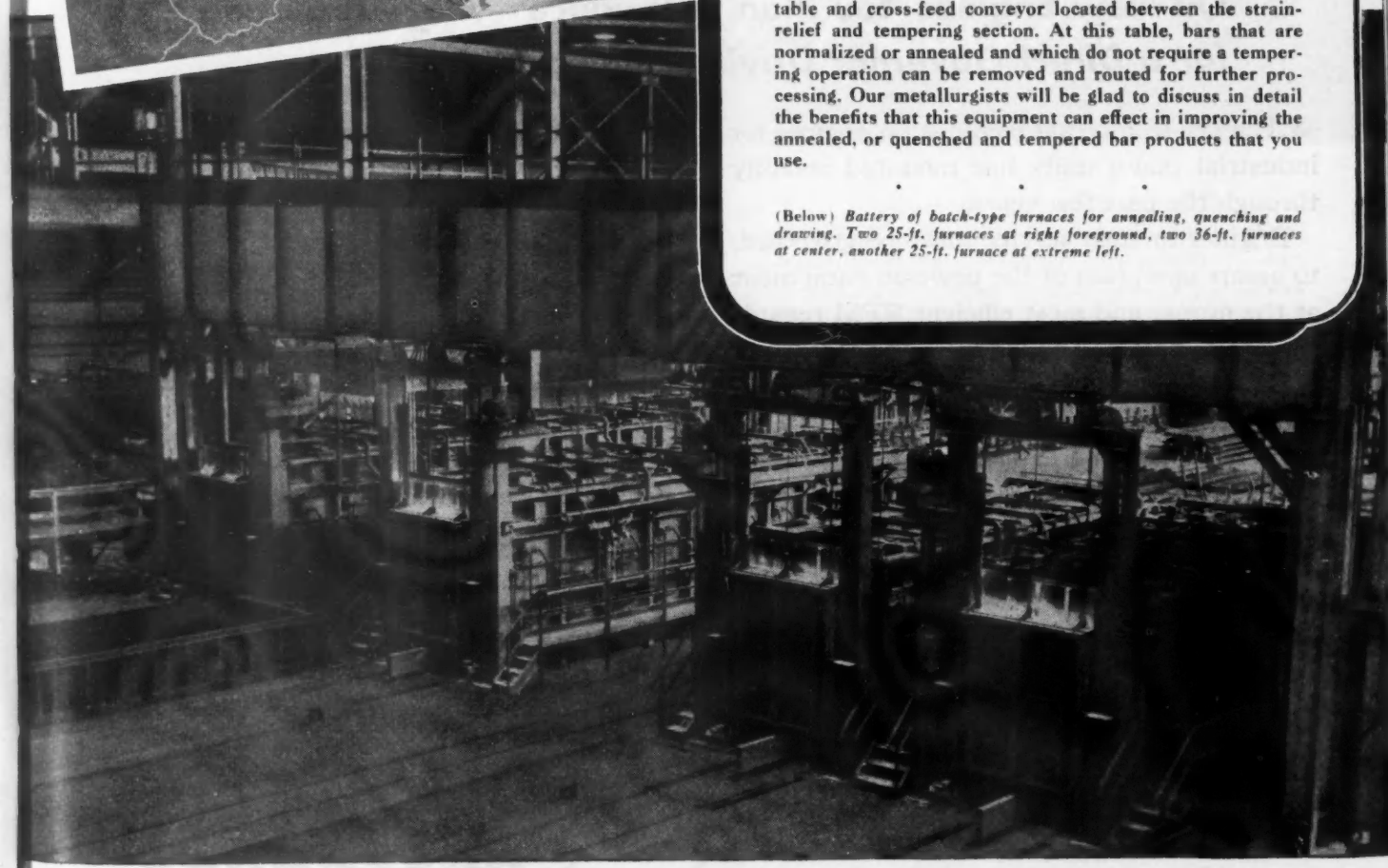
Novel straight-line, 7-chamber Continuous Heat-treating Furnace assures high and uniform quality

In sequence of operation, the line consists of (1) a heating section divided into preheating, intermediate, and high temperature chambers, each with separate doors; (2) a quenching tank for either oil or water quenching under automatic cycle control; (3) a strain-relief furnace; (4) center discharge and cross-feed transfer table, and (5) a tempering section. This last section, like the heating section, is also divided into three chambers, each with separate doors.

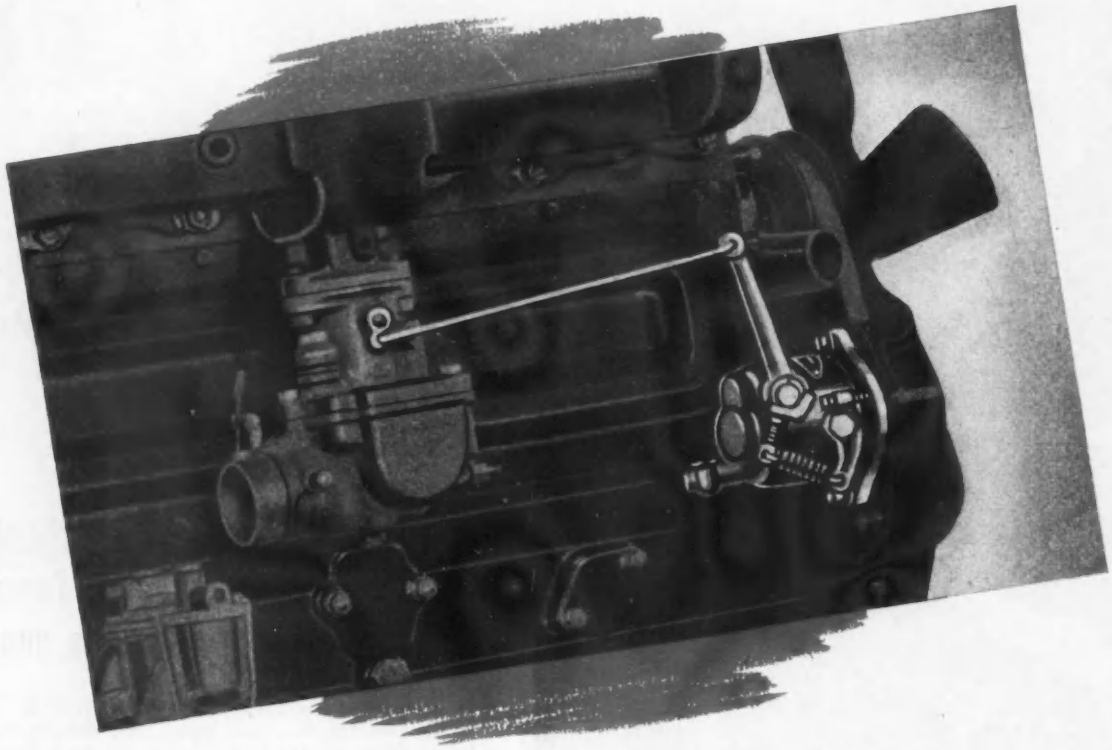
Extreme flexibility is obtained in the unit by the discharge table and cross-feed conveyor located between the strain-relief and tempering section. At this table, bars that are normalized or annealed and which do not require a tempering operation can be removed and routed for further processing. Our metallurgists will be glad to discuss in detail the benefits that this equipment can effect in improving the annealed, or quenched and tempered bar products that you use.

• • •

(Below) *Battery of batch-type furnaces for annealing, quenching and drawing. Two 25-ft. furnaces at right foreground, two 36-ft. furnaces at center, another 25-ft. furnace at extreme left.*



UNITED STATES STEEL



An Important Advantage!

On New Engines You Plan to Produce—*Make Provision for a Direct Governor Driving Outlet*

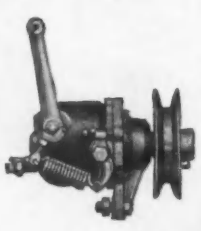
● The use of internal combustion engines for industrial power-units has mounted steadily through the past few years.

Engines in such service must be governed, to assure operation of the powered equipment at the proper and most efficient RPM regardless of varying load conditions; and to protect both the engine and equipment against damaging overspeeds.

Users know that greater efficiency and longer trouble-free service are realized when the governor is driven directly through an outlet designed precisely for the purpose.

It is only natural to assume that these engine users will prefer power-units equipped with such governor-driving outlets when they replace their present equipment.

It is easy to provide such an outlet on the engines you are designing now for future production. There are so many convenient ways for the outlet to be included that no engine should be without its advantages. Pierce engineers, with a broad background of knowledge and experience, are always ready to advise or otherwise assist you with this problem.



PIERCE GOVERNORS

THE PIERCE GOVERNOR COMPANY, INC.
1637 OHIO AVENUE · ANDERSON, INDIANA

Manufacturers of Pierce Precision Governors and Sisson Automatic Chokes

Canadian Manufacturer and Distributor:
BURLEC LIMITED, Toronto 13, Canada

Shaped for Flight!

HERE two hollow rib-reinforced steel forgings begin to assume the subtle contours of Aeroprop propeller blades. They are being shaped on one of the many machines especially designed to mass-produce a new idea in propeller design—a propeller with hollow, rib-reinforced steel blades—a propeller unit-constructed for easy maintenance—a propeller combining all of the qualities of strength, lightness, and simplicity—a propeller less than three years old, yet famous today on every fighting front—the AEROPROP.

Today, thousands of Aeroprops are in service as thousands more move down production lines to take their places on new swarms of Allied fighters. That this has been accomplished in so short a time is further proof that America's skilled workers and production-wise machinery is an enormously resourceful and productive combination.

Today this combination is shaping Aeroprops for war, and for nothing else. When it's won these men and these machines will continue their leadership in the design and construction of modern propellers. Their job then, as now, will be to shape the progress of the conquest of the skies.

KEEP 'EM FLYING! BUY BONDS!

Aeroprop

ARMY E NAVY

In War and Peace, Propeller Production at its Best!

AEROPRODUCTS DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

GM ARMS FOR VICTORY

Next Time Your Shoes Get Soaked

REMEMBER there are other things besides shoes that can become soaked and heavy.

For instance, the thousands of resilient parts of a plane—oil seals, hose, packing, gaskets, grommets, diaphragms—also may absorb petroleum products like shoes soak up water. And this dead weight not included in the original design calculations may seriously handicap the performance of a plane.

But Hycar synthetic rubber with its light weight and superb resistance to oil to keep it light, provides protection against excessive dead weight not offered by any other comparable material. Hycar is 15% to 25% lighter than many other synthetics, and retains this important quality throughout its long life. Further, oil-swell can be closely controlled to insure dimensional stability of parts.

Hycar has an operating range of −65° to +250° F. and abrasion resistance 50% better than natural rubber. Unlike many other oil-resistant synthetic rubbers, Hycar has a minimum tendency to cold flow after taking the initial deformation, even at elevated temperatures.

These are qualities you need in resilient materials used in the presence of oil and gasoline. Let our technical service staff help solve your individual problems. *Hycar Chemical Company, Akron 8, Ohio.*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber

For this we fight

That thread of smoke reaches across the world to the heart of an American soldier. For him that little glass ashtray is the shrine of all he loves. His little daughter had marched proudly into the dime store back home with ten pennies in her chubby fist — ten determined self denials "for Daddy." Gravely she had selected it — paid for it — carried it home. Her "very very best picture," hacked from a precious story book, was pasted on the bottom where it showed through the glass "like teacher said" . . . her very best . . . as a present for Daddy. Small wonder it stands by his chair — waiting —

To us that glass tray holds a different meaning . . . a glimpse of the future America. It was made in a mould cut before the war by one of our machines — the Keller. Today thousands of Pratt & Whitney machine tools are making arms for our soldiers. But when it's over and our boys come back, these machines will work in vast new American industries — peace time industries — providing jobs for those boys and money to buy American products that make life more pleasant.

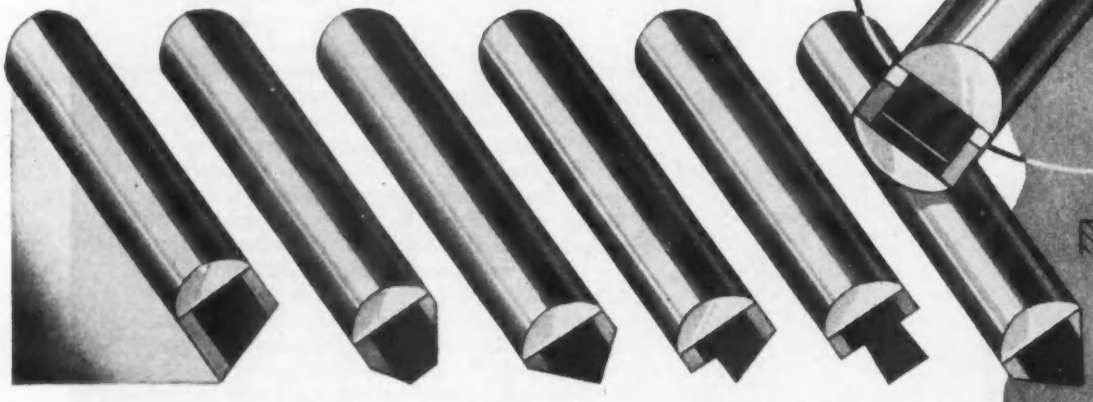
We are proud that Pratt & Whitney precision tools are helping to bring our boys back safely . . . prouder still that they will help guarantee them jobs when the lights go on again.

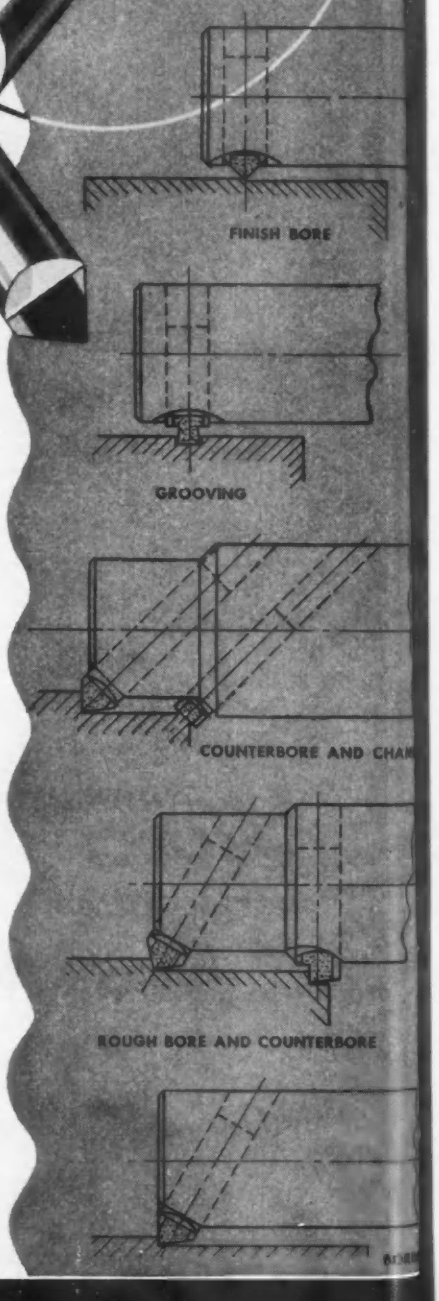
PRATT & WHITNEY DIV. NILES-BEMENT-POND CO. **WEST HARTFORD, CONN.**

A UNIVERSAL-USE TOOL

for LIGHT BORING, FACING, GROOVING AND Precision Finishing

YOU GRIND TO SUIT





Typical Shapes Quickly Adapted...

For practically the entire range of light boring, facing, chamfering, grooving work, and precision finishing, you'll find Carboloy Round Shank "Boring" Tools combine long tool life, low tool cost and low machining cost per piece, with outstanding quality of work. Widely used by industry, particularly for precision boring, to obtain tolerances as close as .0001" and "mirror finish" that frequently eliminates grinding.

Available, cylindrically ground, with either back rake or flat top, in sizes 5/16" through 1/2". Solid Carboloy Cylindrical Blanks, 3/32" through 1/4", also available for boring tool use. In stock for prompt delivery. Catalog GT-175 on request.

CARBOLOY COMPANY, INC.

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TRADEMARK

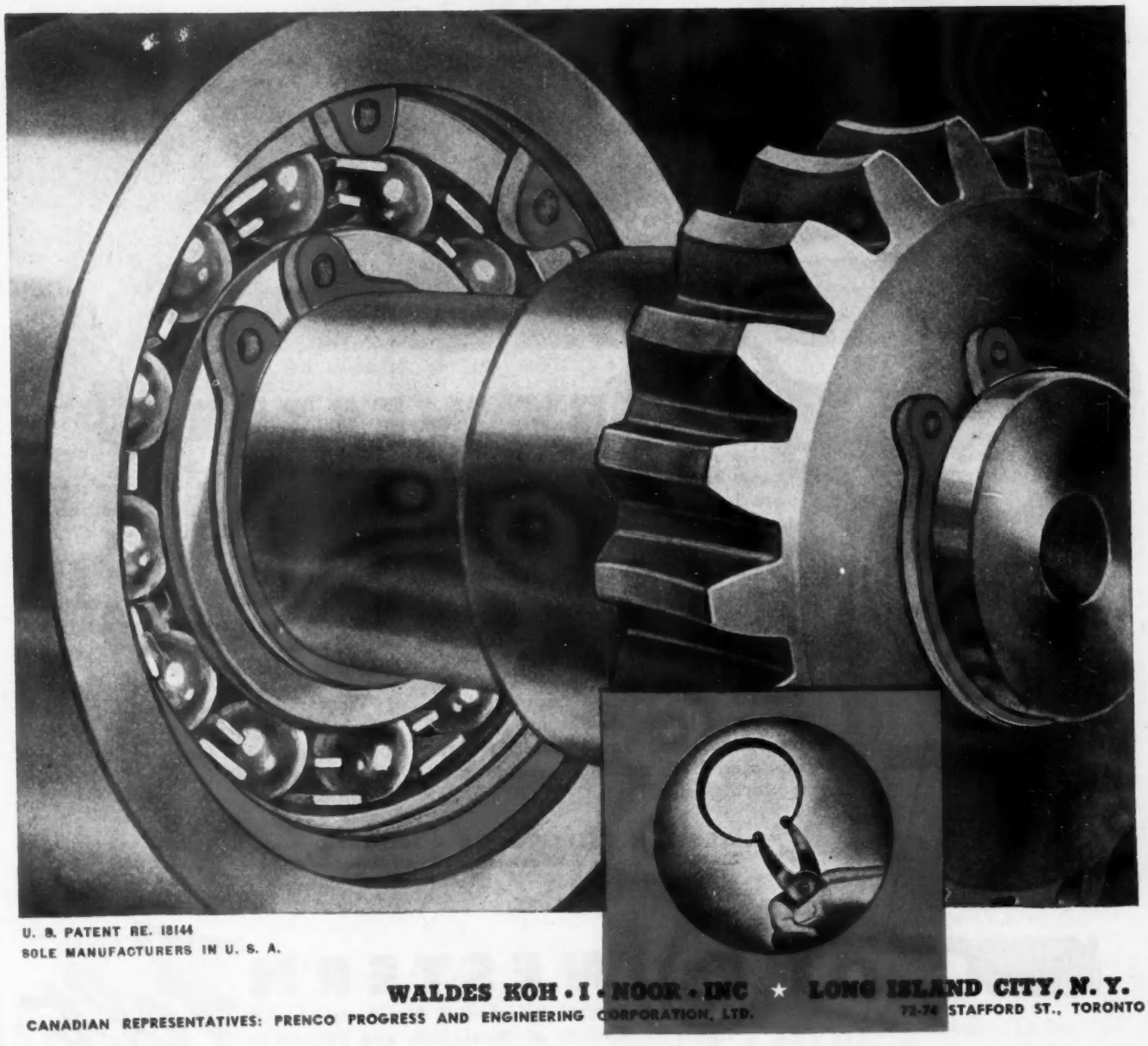
Waldes Truarc presents a significant advance in retaining rings.

It spreads or contracts without distortion; always retaining its perfectly fitting circular contour.

WALDES TRUARC RETAINING RING

For thrust-load fixing, and shaft and housing applications, Waldes Truarc provides distinct advantages over nuts and bolts or wedges and washers... it reduces dimension and weight... saves material... cuts manufacturing time... simplifies assembly and dis-assembly.

On request, we will gladly furnish samples and full data for your tests.



U. S. PATENT RE. 18144
SOLE MANUFACTURERS IN U. S. A.

WALDES KOH-I-NOOR INC ★ LONG ISLAND CITY, N. Y.

CANADIAN REPRESENTATIVES: PRENCO PROGRESS AND ENGINEERING CORPORATION, LTD. 72-74 STAFFORD ST., TORONTO

FOILING THE SABOTAGE OF NATURE—

Felt BY WESTERN!

Enemy agents never dreamed of acts more destructive to machine parts than desert sand storms. Yet—thanks to felt—delicate, vital instruments remain unharmed through storms that bite and scratch men *under their clothing!*

Felt by Western, in many forms, is protecting airplanes through Nature's destructive acts. As washers, channels, gaskets, pads, weatherstripping, thermacoustic lining, cushioning gaskets, insulation, etc., Western felt is safeguarding both machines and men in modern planes.

Western uses its 45 years' experience in engineering and manufacturing felt to take full advantage of felt's many properties—resiliency, flexibility, compressibility, resistance to age, heat, water, oils, shock, etc.—by selecting the right combination of properties to fit each felt part specifically for the job it is to perform.

Western engineers are prepared to give you the complete story of felt's place in modern planes, and to suggest new uses for felt in your product. Write us today.

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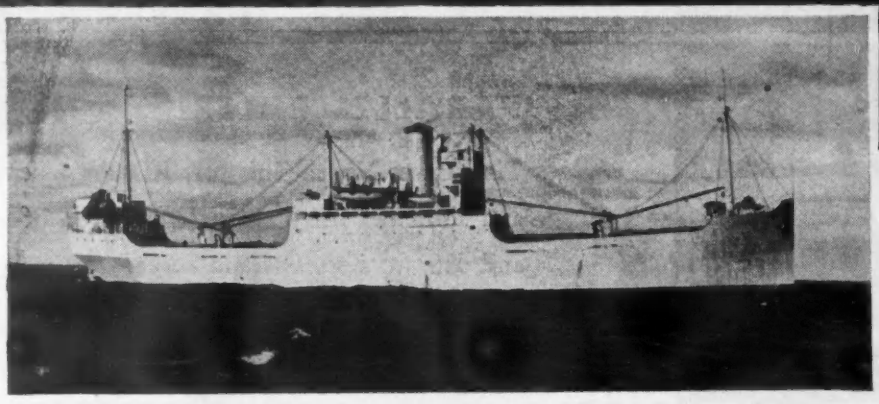
Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts

Yes: Steam Engines, *too, use*

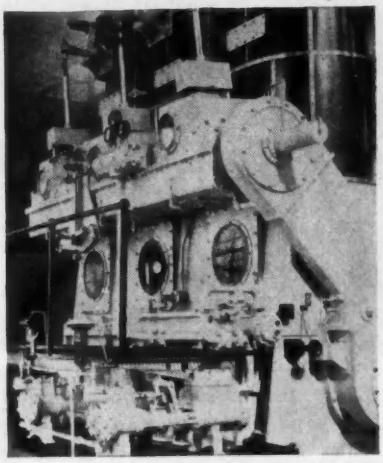
PORUS-KROME*



"Ajax Compound Uniflow" steam engine (below) which powers coastal type freighters (left). After maiden trip of this ship to South America and return (8,000 miles) PORUS-KROME showed no measurable wear.

The Ajax Iron Works, designers and builders of steam engines, at Corry, Pennsylvania, are using PORUS-KROME on piston valve bushings and cylinder liners. Of the results in their Compound Marine "Uniflow" steam engine for coastal freighters, they write as follows: "*The reason we selected PORUS-KROME was to reduce the friction of the ten rings on the valves to a minimum, thereby reducing the amount of cylinder oil which would be required. From this standpoint, PORUS-KROME has proved highly satisfactory, and the first of these engines has now been in service for approximately one year with records of less than one pint of cylinder oil per 24 hours of continuous running. In our opinion, PORUS-KROME is a most satisfactory wearing surface for main pistons and piston valve bushings for modern, high-pressure, high-temperature steam conditions.*"

PORUS-KROME fulfills a vital function on bearing surfaces in engines for ships, submarines, tanks, planes, buses, trucks, stationary and mobile power units, and locomotives. Van der Horst engineers are ready to show you how PORUS-KROME can improve the reliability and economy of the engines you are planning for postwar sales.



*PORUS-KROME is pure chromium, applied by the Van der Horst process that produces pores to hold oil. It reduces wear and corrosion and greatly multiplies cylinder life. It is being applied to engine parts in 3 Van der Horst plants and by license agreement.

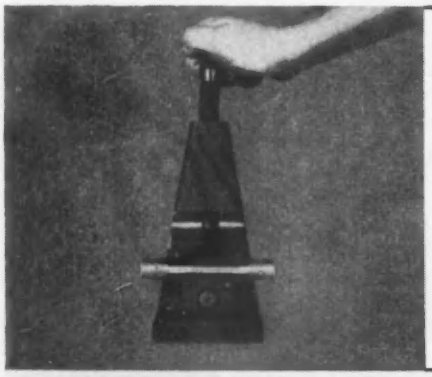
PORUS - KROME

VAN DER HORST

Good for the Life of your Engines

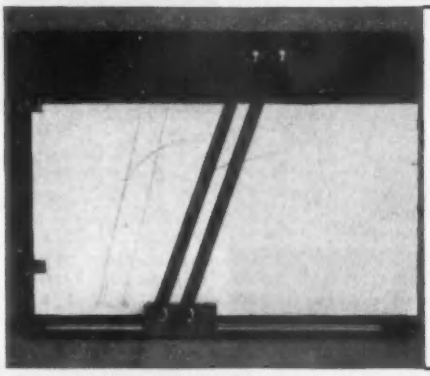
VAN DER HORST CORPORATION OF AMERICA CLEVELAND 11 · OHIO OLEAN · NEW YORK

3 helpful time-savers for the LABORATORY



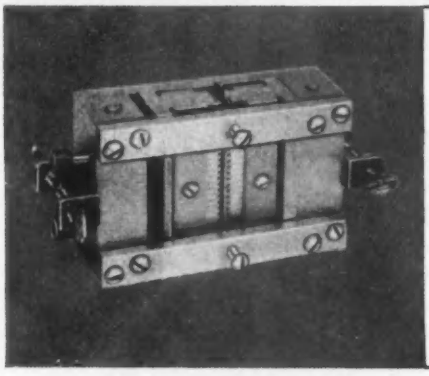
1. GAGE POINT PUNCH

Time-Saver No. 1 . . . automatically centers either round or flat specimens. Marks four uniform 2-inch gage-length centers with one push of the handle. Automatically adjustable to suit soft or hard materials. Accommodates rounds ⅛" to ¾" dia.; flats ½" to ¾" wide and zero to ¾" thick.



2. PARALLEL RULER

Time-Saver No. 2. This parallel ruler assembly facilitates and simplifies the rapid determination of yield strength, and data from stress-strain curve.



3. EDGE-COMPRESSION TESTING JIG

Time-Saver No. 3. This simple inexpensive new jig permits direct determination of compression yield strength from a single test sheet, rather than use of a pack. Simplifies testing technique.

BALDWIN PRODUCTS

Hydraulic presses, Testing equipment, Steel forgings and castings, Diesel-electric locomotives, Diesel engines, Metal plate fabrication, Rolled steel rings, Bronze castings, Heavy machine work, Crane wheels, Bending rolls, Plate planers, Babbitt metal, Alloy iron castings, Briquetting presses.

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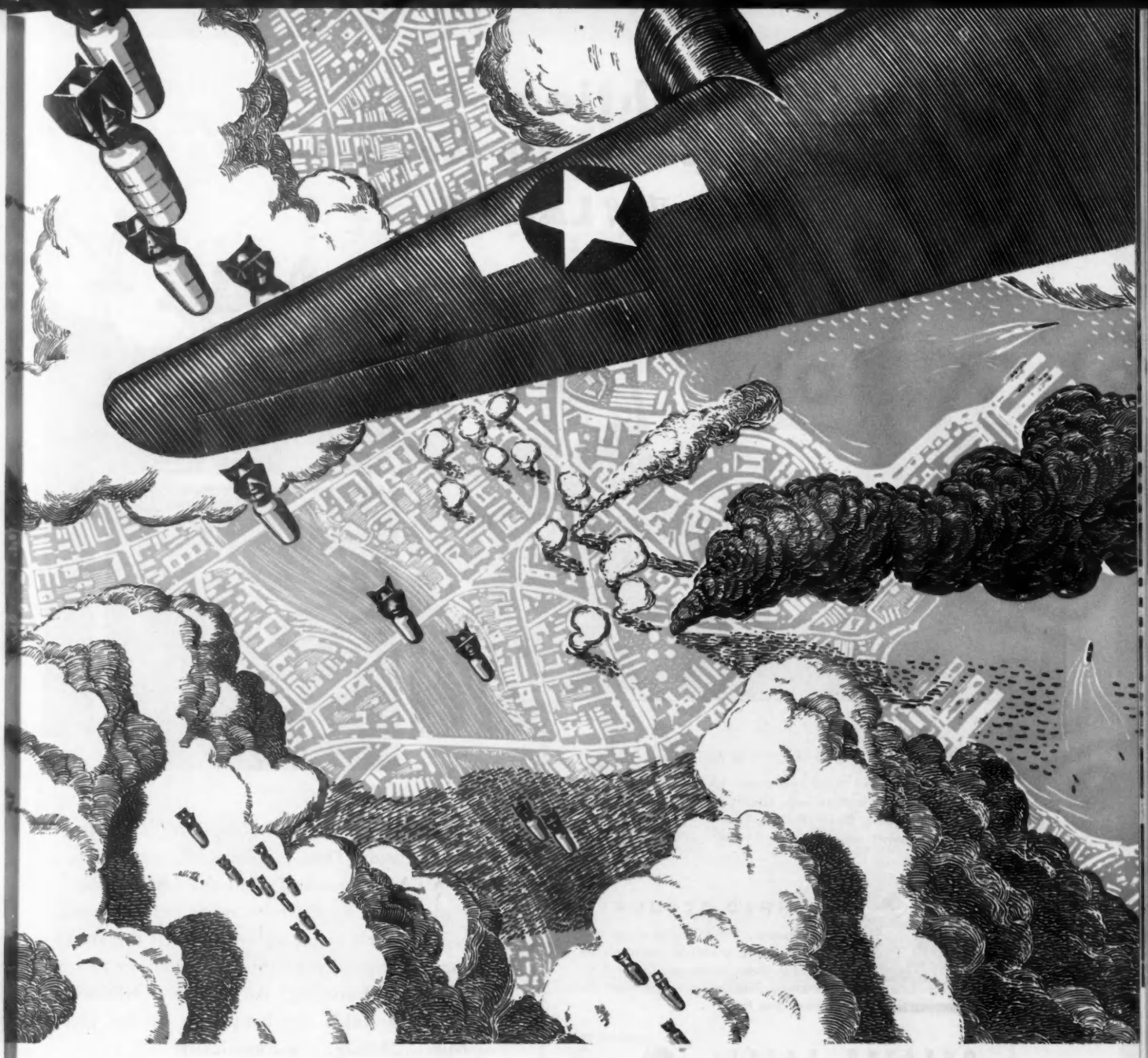

Turning Point

● Shortly after the first world war, Eaton engineers were working feverishly with a hollow, self-cooling valve that would permit airplane engines to cover long distances at high speed without overheating.

Progress was made—and much was learned during those trying days. And the work continued, in conjunction with aircraft engineers.

The famous Sodium-Cooled Valve was the result. *It marked the turning point in aviation history.*

Because of the Sodium-Cooled Valve, thousands of fast, powerful military planes are now able to fly long distances and bomb out strategic enemy targets. Airplanes patrol the convoy lanes. Airplanes map hostile territory. Airplanes carry military freight and passengers to every way-point in the world. And airplanes *may well force a turning point in the war.*

Yet the real development of the airplane still lies ahead. It is a story of progress that is still in its opening chapters.

When peace comes again, still larger, finer airplanes will bring about *a turning point in long distance transportation of all kinds.* Global air routes will cut time and distance —and bring revolutionary changes in living habits on every continent.

Eaton considers it a great privilege, as well as a great responsibility, to be so closely associated with the great new American industry that is destined to change the history of the world.

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EATON MANUFACTURING COMPANY

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Get flexible lighting

for each employee . . . each job . . . with DAZOR *Floating* LAMPS

MORE PRODUCTION

Both machine and hand operations go faster, more smoothly, with controlled localized lighting. Dazor *Floating* Lamps help employees improve and maintain efficiency.

HIGHER ACCURACY

Adequate lighting aids precision, reduces errors, conserves materials by cutting down spoilage. Dazor high intensity illumination is just right for inspection tasks.

GREATER SAFETY

By lighting dark areas and danger points, eliminating reflected glare, reducing eyestrain and fatigue, Dazor *Floating* Lamps help to check accidents at the source.

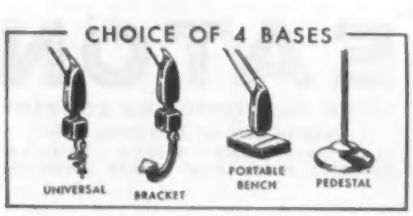
LOWER COSTS

Dazor *Floating* Lamps deliver productive, economical light. Option of fluorescent or incandescent lamps and 4 base types provides a correct fit for each installation.

Employees differ . . . and jobs differ . . . in their lighting needs. That, in a nutshell, is the reason for the Dazor *Floating* Lamp—the first lamp with complete lighting *flexibility* at the point of work. The operator's finger-tip touch *floats* the Dazor Lamp to the exact position desired, where it *stays put* without fastening. An enclosed balancing mechanism holds the lamp arm at the place chosen . . . firmly . . . automatically.

At the left are typical advantages of Dazor illumination on machine tools, assembly lines, inspection benches and drafting boards. To gauge these economies fully, get details from your experienced and cooperative Dazor-appointed distributor. If you'd like this 16-page descriptive booklet, ask for Booklet "I"; we'll send it promptly. Dazor Manufacturing Co., 4469 Duncan Ave., St. Louis 10, Mo.

CHOICE OF 4 BASES



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DAZOR *Floating* LAMPS

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Navigators sight accurately through Plexiglas astrodomes

Over the target with precision . . . home to a distant base . . . navigators guide America's bombers on their far-ranging flights

* * *

THEY sight their octants through curved PLEXIGLAS sections called astrodomes. These are precision optical parts, every one meeting critical sighting specifications—yet Rohm & Haas has made them by the tens of thousands, using a special vacuum forming process developed in our plant before the war.

As pioneers in the manufacture and fabrication of acrylic plastics, Rohm & Haas has assisted in the successful use of PLEXIGLAS in hundreds of other aircraft and automotive applications.

TECHNICAL COOPERATION

You are invited to take advantage of the cooperation of the Rohm & Haas technical staff in the determination of best optical contours . . . discussion of mechanical details . . . fabrication of experimental sections . . . and assistance in all other phases.

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Produced at Low Cost on...

AJAX *High Speed* Forging Presses

Forgings of aluminum, brass, magnesium and steel for aircraft parts, shell parts, valves and many types of hydraulic fittings can be produced at high production speeds on AJAX Forging Presses. Production by this forging process shapes the grain flow so that the finished forging has a denser, stronger structure for maximum reliability.

The air clutch on the main shaft provides instantaneous application of tremendous pressure in response to the treadle. This not only makes possible higher operating speeds but results in better filled die impressions without excessive flash. Even small parts of intricate design can be forged to close tolerances, economically on AJAX FORGING PRESSES.

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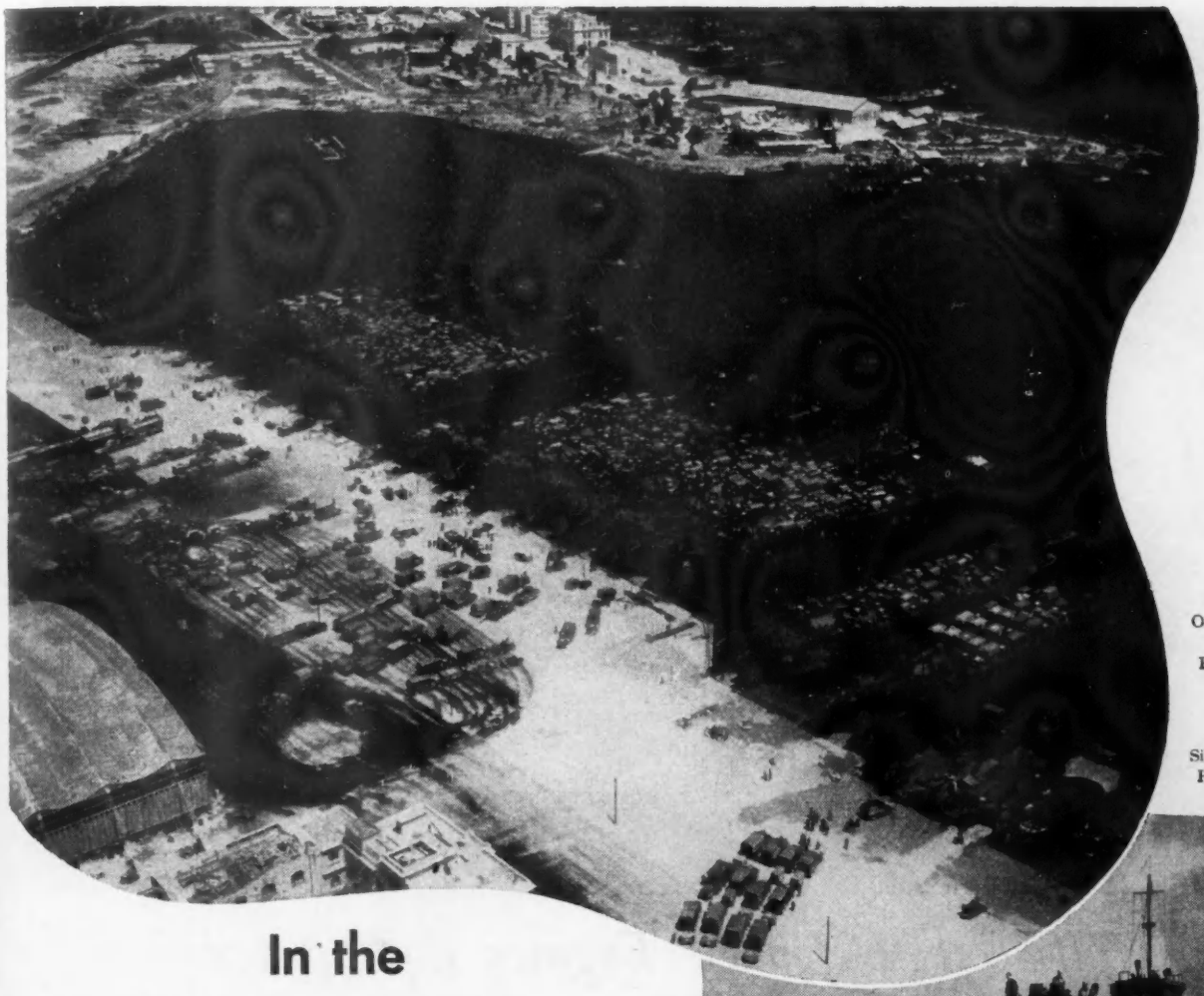

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In the vanguard of *Invasion*

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Wherever our fighting forces go, Great Lakes Steels go too . . . N-A-X ARMOR PLATE, N-A-X HIGH TENSILE and N-A-X 9100 SERIES STEELS—in practically every type of combat equipment. This widespread war use of these metals is indicative of their importance in the peacetime products of tomorrow. A unique combination of outstanding advantages *guarantees* it . . . (1) Great strength and toughness. (2) High resistance to impact and fatigue. (3) Excellent fabricating features. Write for our booklet on N-A-X Low Alloy Steels. It may start you on a profitable line of thought.

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When a plane is forced down at sea, nothing is more welcome to the stranded crew than this alert fisherman —the 63-foot aircraft rescue boat, now employed on every fighting front, and equipped to fight off enemy sea and air attack with depth bombs and 50MM. guns, while on the watch for crews of crippled planes.

Twin Hall-Scott "Defender" engines give high maneuverability and excellent cruising range to these rescue boats. Federal-Mogul sleeve bearings equip the Hall-Scott "Defender" engine, as well as the power units on many Allied planes, tanks, torpedoes, trucks, submarines.

Around the clock our six well-equipped plants produce tens of thousands of bearings, bushings and similar precision parts for war service. After the war, we will be in a position to switch almost without interruption to bearing production for the automobiles, trucks, refrigerators, diesel engines, tractors and many other much-needed peacetime power units. Wherever shafts turn in sleeve bearings, for 45 years FEDERAL-MOGUL sleeve bearings have been the recognized standard of dependable quality.

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Sleeve bearings and bushings designed, developed and manufactured for engines, pumps, compressors, large machine tools and all applications where such parts are used.

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CONTROLLED SPLIT-SECOND STOPPING POWER FOR ANY PURPOSE

The Machine of Tomorrow— TODAY!

Sav-way SPITFIRE

ELECTRO-HYDRAULIC INTERNAL GRINDER

Modern Functional Design Throughout

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Electrically-Operated Diamond Wheel Dresser

Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32″ minimum table stroke! Gatling gun table speed, through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

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THE SECRET OF TOP QUALITY FASTENERS

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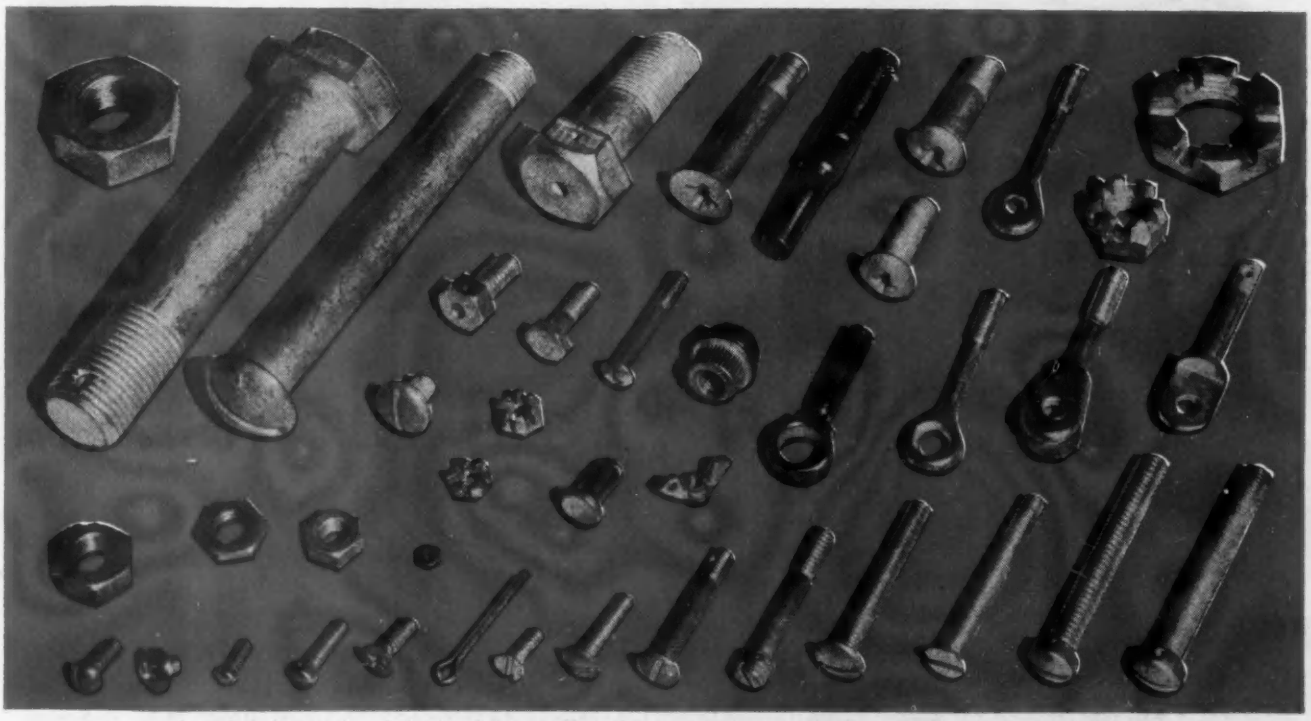

As a principal source of supply for aircraft fasteners, National Screw products an exceptionally complete line of AN and NAS bolts, nuts, screws, rivets and other headed and threaded products, including many "specials" designed by individual aircraft manufacturers.

Because we know that rigid inspection is the best insurance of quality, our inspection department comprises 12 per cent of our factory personnel. This results in a standard of uniformity and freedom from rejection that is extraordinary in the industry.

National's engineering and metallurgical experience, modern manufacturing and heat-treating facilities, large capacity and closely integrated production layout, including our own wire mill, equip us to give our customers exceptional service.

Substantial savings to our customers have been effected in many cases by cost cutting methods which we have developed, particularly in adapting cold heading to many parts previously made milled from bar.

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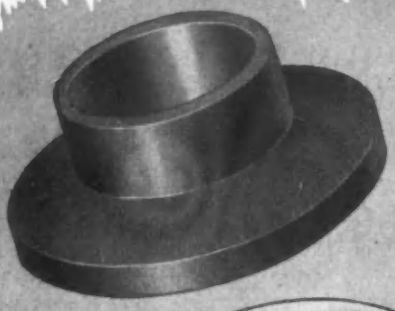
NATIONAL aviation products include many special parts, such as carburetor studs, motor mounting bolts, stainless eyebolts, brake adjustment screws, gyroscope struts, dome nuts—to name just a few. Our engineers will be glad to work with you on any fastener problem and give you the benefit of *National's* wide experience.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.



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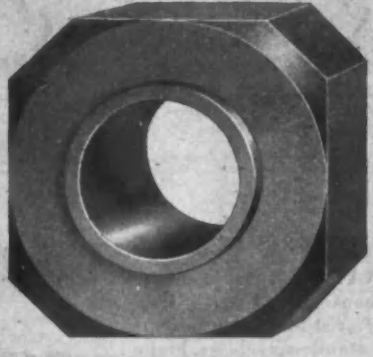

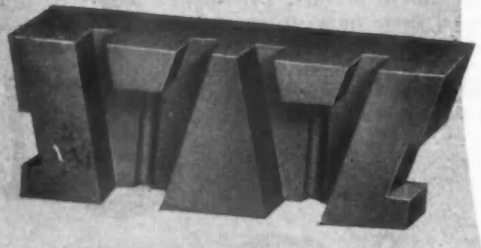

Jessop Cast-To-Shape Steels, formed to exact specifications, require only minimum machine finishing and help break bottlenecks in production, thus reducing costly delays and expensive man-hours in machining.

Jessop Tool Steels Cast-To-Shape are available in air-hardening, oil-hardening, flame-hardening, heat-resisting, and stainless types as well as in special analysis to meet individual needs. Castings are always furnished in annealed condition.

Typical applications include forming dies, blanking dies, tooling dies, shear blades, swaging dies, mixer paddles, spinning rolls, punches and dies on hot work presses, and many others. Jessop Cast-To-Shapes in heat-resisting and stainless steels are also being utilized in the production of glass molds. Jessop metallurgists, having a knowledge of casting problems and mechanical requirements, will be glad to consult with you. Send us your specifications.

ARMY E NAVY
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Established 1901

JESSOP STEEL Co.

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Born of wartime necessity, a new phase of highway transportation has already proven itself eminently successful. With trucks literally snatching the raw product of the rolling mill to feed the eager machines of factories, often many miles distant, fortunes in valuable time are saved . . . not to mention the establishment of hitherto unheard of advantages in correlation ★ Without exception, the leaders in this bustling new division of the trucking industry rely upon genuine Bendix-Westinghouse Air Brakes and Pneumatic Controls for their all-time-high record of safety and economy. Even in the face of wartime exigencies, this modern power-to-stop has clearly demonstrated the many exclusive advantages it holds for every motor transport operator ★ Of course your business is different. And that's just why we invite you to confer with your local authorized Bendix-Westinghouse Distributor who, without obligation, has a story concerning Air Brakes for your specific operation which is guaranteed to save you money.

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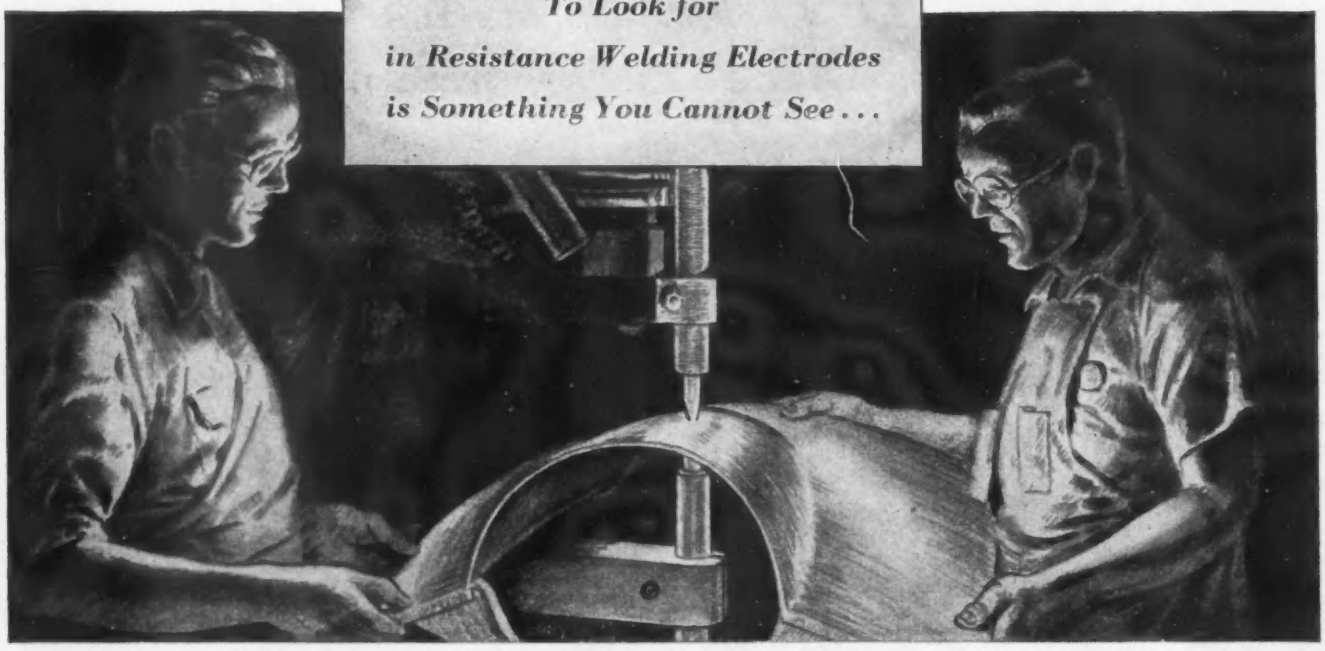
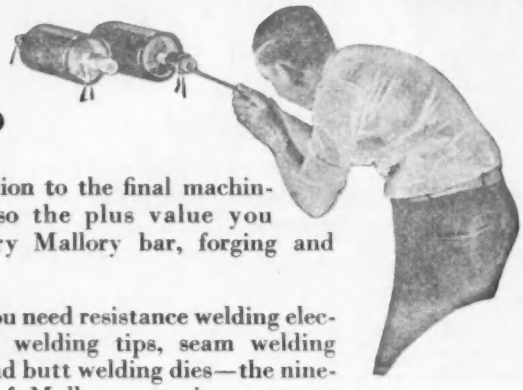
IT IS SIGNIFICANT THAT AMERICA'S FINEST MOTOR TRUCK FLEETS ARE EQUIPPED WITH BENDIX-WESTINGHOUSE AIR BRAKES

The Most Important Thing
To Look for
in Resistance Welding Electrodes
is Something You Cannot See . . .



Mallory Metallurgical Knowledge . . . Behind the Faster, Better Welding Job



Speed—without loss of quality—is the watchword of every war plant. Mallory sets the pace with dependable, long-life resistance welding electrodes that produce better welds in fewer man hours.

Standard Mallory electrodes save the costly delays formerly involved in producing special tips. Mallory alloys—Elkaloy*A, Mallory 3* Metal, Elkonite*—greatly reduce "down time" for redressing and replacement.

Back of this combination of speed and excellence lies Mallory metallurgical knowledge. It extends through every step of electrode production, from the exact proportioning of the composition to the final machining. It is also the plus value you get in every Mallory bar, forging and casting.

Whenever you need resistance welding electrodes—spot welding tips, seam welding rolls, flash and butt welding dies—the nineteen years of Mallory experience are at your service. Mallory experience can help you determine the right size and contour of electrode for the job, and the type of alloy best suited for its requirements. It can lead, as it has frequently led before, to stronger, lighter, more easily fabricated products at lower cost.

ARMY E NAVY

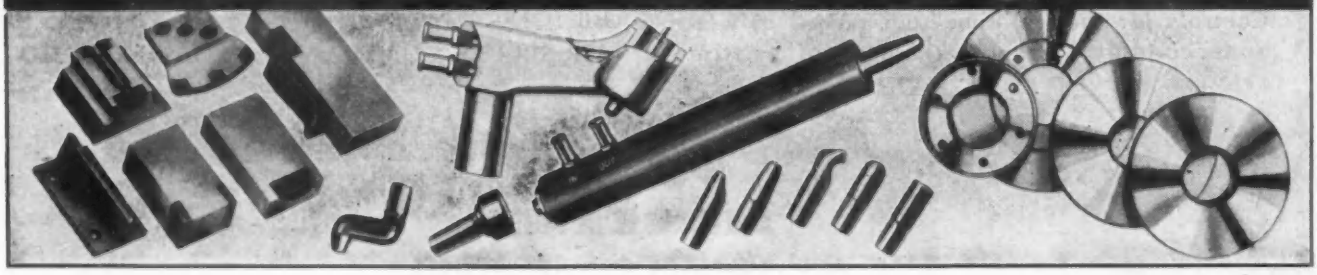
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Invest in Victory —Buy More War Bonds

*Reg. U. S. Pat. Off. for metal compositions

P. R. MALLORY & CO. Inc

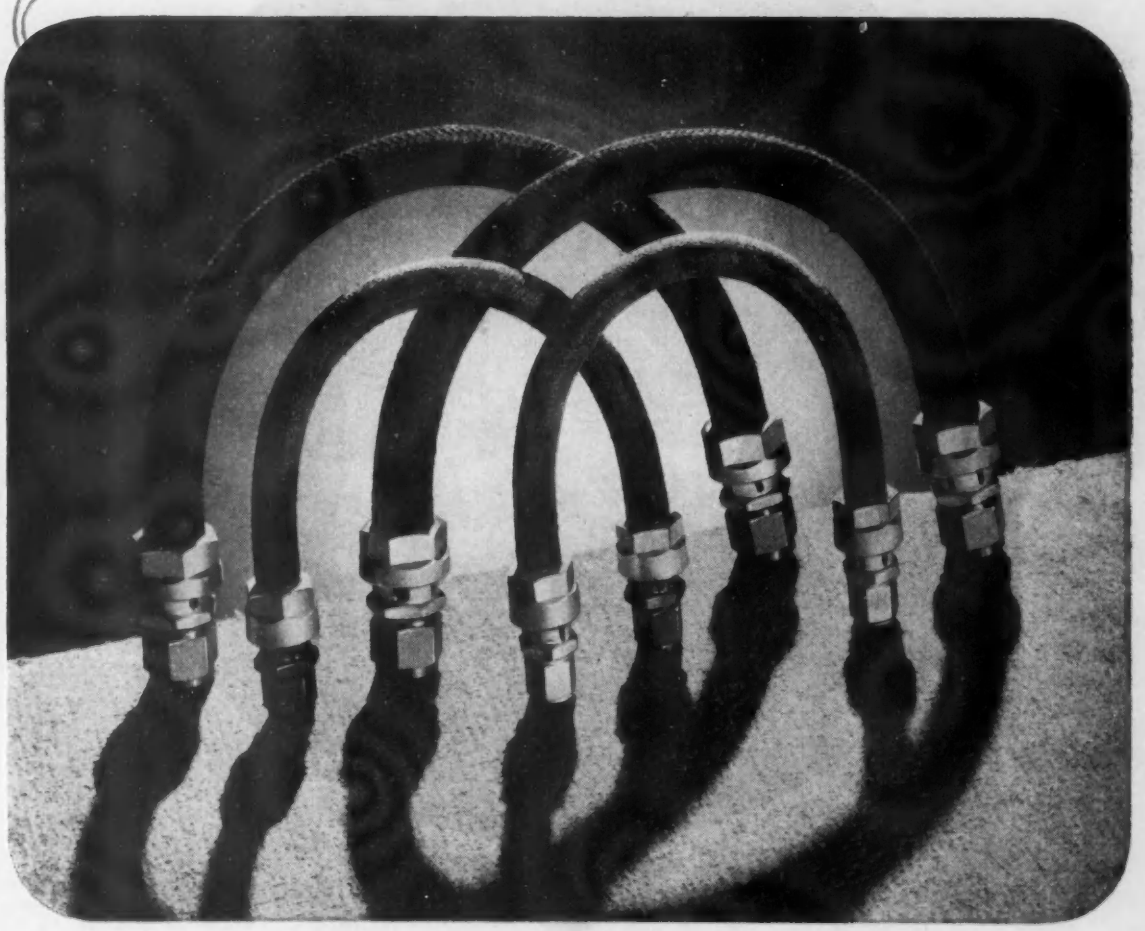
MALLORY *Standardized Resistance Welding Electrodes*



Life lines OF MACHINES AND MEN!

This is a good picture of four strands of FLEXIBLE HOSE—but no picture at all of their dramatic part in modern warfare. It would take moving pictures to tell *that* story! You'd see water, fuel and oil rushing through them at the height of battle . . . in planes, tanks, ships and combat cars in every sphere of combat.

Truly the wartime function of simple flexible hosing is equalled only by its peacetime potentialities. As the world's largest manufacturers of this product, the four plants of The Weatherhead Company have played a prominent part in the nation's war effort—and are prepared to assume the same role in Peace.



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Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
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FREE: Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.

HOW TO IMPROVE ACCURACY AND STRENGTH OF SPLINES

AT NO INCREASE IN COST

Here stronger — involute — splines are being finished on a Michigan Gear Shaver at 70-80/hr. to virtually zero backlash (tolerances: 0.0001-0.0002″). The saving in hobbing cost alone offsets the expense of the shaving operation.

For complete information on gear finishing, ask for Bulletin GF-43

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

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For low cost precision holes...

and finer finish...faster

Wetmore type 7 shell reamer

• Wetmore shell reamers are modern tools—precision built for precision work. They have the exclusive Wetmore features that assure top production, finer finish and economy of long tool life. Wetmore shell reamers are available in sizes from 1-1/4" to 6" cutting diameters, with right or left hand angle blades in carbide or high speed steel.

When the job requires precision reaming, high production and low cost—it's an ideal job for Wetmore tools. That is why they are widely used in so many top-flight metal-working plants.

Send for this New Tool Guide—it is full of data, information and specifications . . . Free to executives and engineers.

Arbors for Wetmore shell reamers are available in straight or tapered shanks.

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WETMORE
REAMERS... BORING BARS

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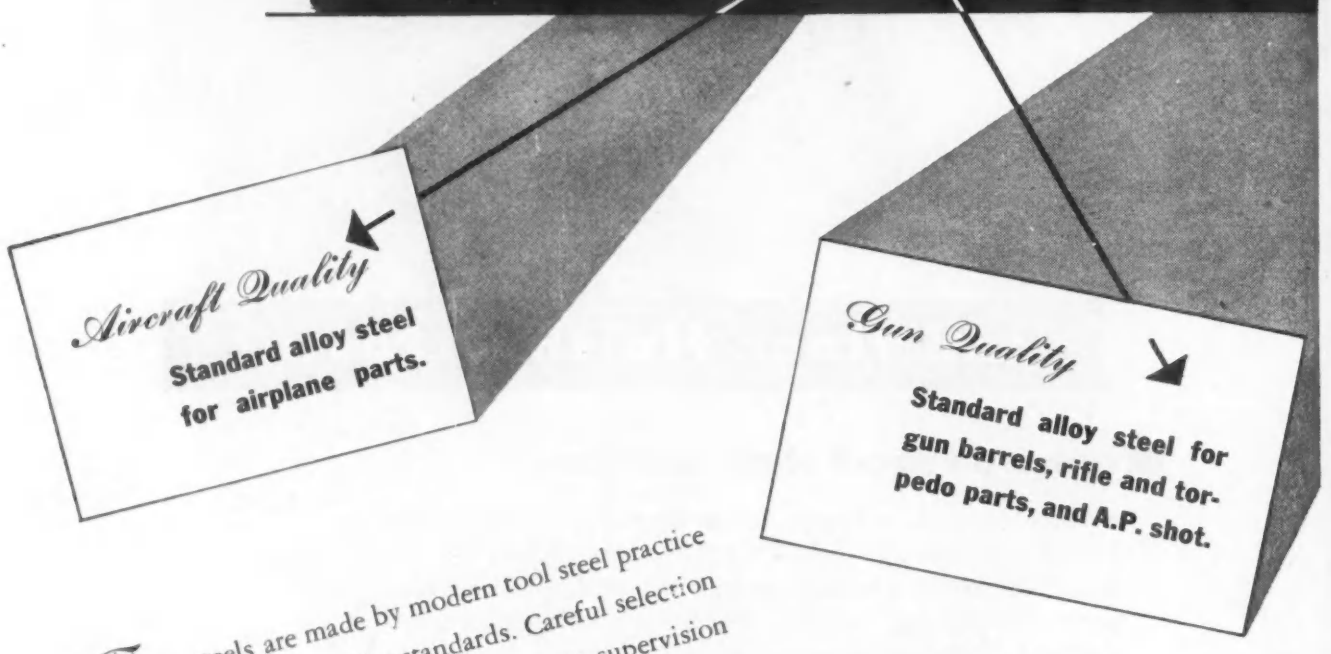
ELECTRIC FURNACE STEELS by DISSTON


Aircraft Quality
Standard alloy steel for airplane parts.
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Standard alloy steel for gun barrels, rifle and torpedo parts, and A.P. shot.

These steels are made by modern tool steel practice to Disston's high quality standards. Careful selection of materials, precise control and expert supervision result in an exceptionally sound and clean product.

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YOUR POSTWAR PLANS

most likely include the use of special steels. Disston metallurgists and engineers can put at your service an unusual background of experience with alloy and carbon steels to help you with your future program. No obligation. Write fully.

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Need a Motor that can lift 500 times its own weight?

THIS electric motor weighs only a pound. But more power is packed in that one pound of motor than has ever been before.

With Lear gearing it can handle a quarter-ton load.

And it has to be ready to do that in an instant. Because this motor moves control flaps, and heater shutters on warplanes. And air pressures mount high at the speed these ships fly.

On aircraft, even the weight of a coat of paint has to be considered. So this motor had to be light.

There's little room in an airplane. So it had to be small.

Designing it meant starting from scratch. There was no precedent for this kind of engineering.

You may never need a motor like this. It may cost more than you might want to pay.

But if you are looking ahead toward manufacturing some peacetime product, we want you to know that such a motor has been developed along with 250 other Lear products.

And equally important, we want you to know that there is available the kind of engineering thinking that could conceive and produce it.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.

PN

JUNCTION BOXES

Over 200 Standard Sizes Available

Box sizes range from 1⅞" x 1⅞" up to 23" x 15".

Material Thickness from .032" to .064" in 2 SO or 3 SO Aluminum.

Covers to fit in 3S½H Aluminum.

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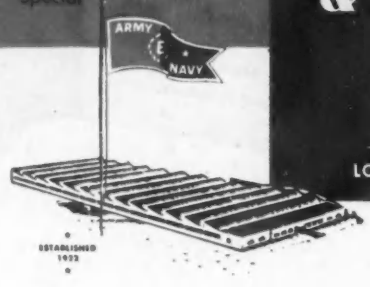
Delivery: 30 days or less.

For complete details of all P & N Junction Boxes please send for Catalog No. 43-JB.



POULSEN & NARDON, INC.

Terminal Box 2398

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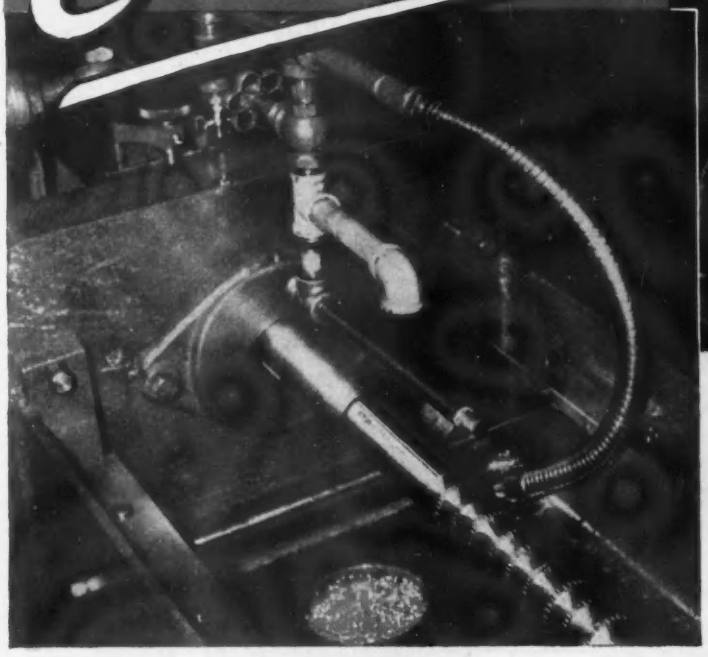
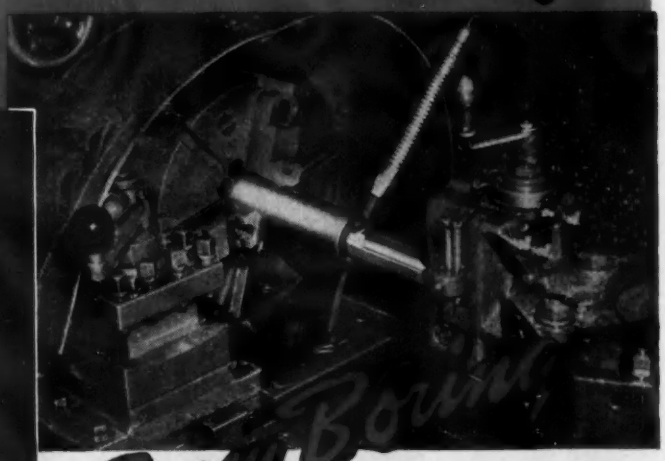
Change to Broaching





From Boring SAVES 48½ MINUTES PER PIECE

A large manufacturer formerly produced hydraulic cylinders for aircraft by boring, grinding and honing. The boring and grinding operations alone required 50 minutes. Now these parts are broached and honed. This method requires 1½ minutes per piece exclusive of the honing. The broaching produces a surface comparable to the ground surface so that both pieces require about the same amount of honing. Thus 48½ minutes are saved on every piece and several turret lathes and grinders, together with their operators, are released for other work.

This is a typical example of the savings in time and cost and the product improvement made possible where Detroit Broach tools and accessories are used. Go over your production plans with a Detroit Broach Company engineer. He may be able to suggest several ways in which broaching can help you gain greater production at lower cost. He will be glad to submit complete cost and production data without obligation to you. Write Detroit Broach Company today.

ARMY NAVY

DETROIT BROACH COMPANY

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Specify BENDIX LANDING GEAR!

Bendix Landing Gear—Bendix Pneudraulic Shock Struts, Bendix Airplane Wheels, Airplane Brakes, Hydraulic Master Cylinders, and Power Brake Valves are important members of "The Invisible Crew" of precision equipment which more than 30 Bendix plants are speeding to world battle fronts.

Bendix smooth operating Pneudraulic Struts play an important role in getting heavily loaded, long-range fighting planes into the air and in bringing them safely down again. Whether the run-way is a smooth, concrete strip on the home field, or a shell-potted clearing of an advanced base, Bendix Landing Gear provides maximum protection for plane and pilot. The strength and shock-absorbing power of Bendix struts and the stopping power of Bendix brakes are pre-determined by scientific testing equipment that reproduces actual flying stresses. Bendix landing gear is serving on all types of planes from the smallest trainer to the largest bomber.

"Bendix-Pneudraulic" is a trademark of Bendix Aviation Corporation.

THE INVISIBLE CREW
Precision Equipment by
Bendix Aviation Corporation

BENDIX PRODUCTS DIVISION OF BENDIX AVIATION CORPORATION • SOUTH BEND, INDIANA

PROPER CLEANING AND RINSING WILL SPEED PRODUCTION AND MINIMIZE REJECTIONS

WHEREVER STEEL IS REQUIRED IN CREATING WAR EQUIPMENT. METAL FABRICATORS AND INSPECTORS WILL FIND THE CAUSE OF MUCH UNSATISFACTORY FINISH TO BE INEFFECTIVE RINSING.

Chemically Clean metal surfaces and why essential, before protective finishes are applied, were discussed in a recent issue.* One more step, the Final Rinse, must be efficiently performed to insure satisfactory results.

The Final Rinse has a profound and critical effect on the corrosion resistance of the final finish. No matter what general method of cleaning is employed, the removal of the cleaning agent itself, together with the contaminants picked up from the metal, is a very critical step in the cleaning operation. Water-soluble salts, objectionable acids and bases constitute the most usual and serious of the invisible, latently harmful surface contaminants spoken of previously.

Almost all cleaning chemicals contain such substances, which are absorbed more or less strongly by the steel surface, and are rinsed off with difficulty. It is, moreover, very difficult to keep rinse water free of these . . . besides, all natural waters contain dissolved salts in greater or less amounts. Obviously, whatever remains on the surface after the rinsing, and whatever is dissolved or suspended in the rinse water film adhering to the surface, still remains when the surface is dried. Traces of alkaline, saline, or water-soluble material in general, even such amounts as may be present in tap water, left on steel surfaces are harmful to paint film.

The Final Rinse following one or more rinses in clear water should be a neutralizing rinse (preferably hot to assist subsequent drying) and contain substances to neutralize and destroy any carried-over alkali or alkaline salt on the surface of the work, or present in the rinse water so that no corrosion stimulative material will remain.

This final rinse should be on the acid side of neutrality, having a pH between 3 and 5 and contain suitable agents to cause the rinse water to drain off in an even film without leaving droplets to dry irregularly on the surface.

It will appear that, regardless of the type cleaning used, the nature of the final rinsing solution has a profound and critical effect on the corrosion resistance of a final finish. The effect of certain variations in rinsing procedure is shown in the photographs of two series of baked enamel panels which have been exposed to salt spray.

Cleaning in a properly formulated phosphoric acid type cleaner, such as Deoxidine, is superior to other types of cleaning such as alkali cleaning—Compare panels of series 1 with those of series 2.

Rinsing in tap water is less harmful on surfaces cleaned with Deoxidine, than on alkali cleaned surfaces, as may be observed by comparing panel No. 1 in series 1 and 2.

In order to secure the maximum benefit of an organic finish, the final rinse should contain phosphoric or chromic acid with additional draining and drying agents. Compare panels 1-2-3 and 7 in series 1 and 2.

The final rinse must be on the acid side of neutrality. The optimum pH range for maximum film durability is from 3 to 5. The results on Deoxidine cleaned surfaces are better than those on alkali cleaned surfaces.

The effectiveness of chromic or phosphoric acid in overcoming difficulties due to absorbed soluble impurities on steel surfaces is improved when these are used in the form of properly formulated preparations, such as Deoxylyte which is designed for thorough contact with the surface, uniform drainage and more rapid and uniform drying.

* A reprint of the previous cleaning article will be sent on request.

EFFECT OF VARIOUS RINSING CONDITIONS

LOW BAKED UREA-FORMALDEHYDE RESIN ENAMEL—40 HOURS SALTSPRAY EXPOSURE

Descriptive literature covering application of Deoxidine and Deoxylyte in cleaning and rinsing operations will be sent free on request to

AMERICAN CHEMICAL PAINT CO., Ambler, Pa.

Please send me general Technical Service Data Sheets on

*Name*_____ *Title*_____ ☐ DEOXIDINE

*Company*_____ ☐ DEOXYLYTE

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OR TUBING AND STAMPING ASSEMBLIES

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Noblitt-Sparks makes and forms metal tubing into any shape—welds it to other parts stamped from metal—assembles, plates or paints the entire unit—ready to go into your product. We've been doing that for many manufacturers—for 25 years—companies who have depended on us for many different kinds of assemblies.

Perhaps we can help you, now or later—with engineering assistance, as well as production. If you have a specific job in mind, write or call . . .

Harlow Faulke

Vice-President and Director of Manufacturer's Parts Division
NOBLITT-SPARKS INDUSTRIES, INC. • COLUMBUS, INDIANA

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has the experience and facilities to produce

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Roll up your blueprints and specifications —dictate a letter outlining your needs— and dispatch your wiring problem to the nearest Whitaker plant. We welcome inquiries covering either war-time or post-war production . . . Backed by a quarter of a century of specialized experience producing wire and cable products, Whitaker has the facilities for large-scale production —plus the ability and "know-how" for quickly turning out cable assemblies to meet rigid specifications.

In addition to an engineered wiring service, Whitaker also offers a quality line of standard cable products. There will be no obligation involved in your getting the facts, so why not write today!

WHITAKER CABLE CORPORATION

(Formerly Whitaker Battery Supply Company)

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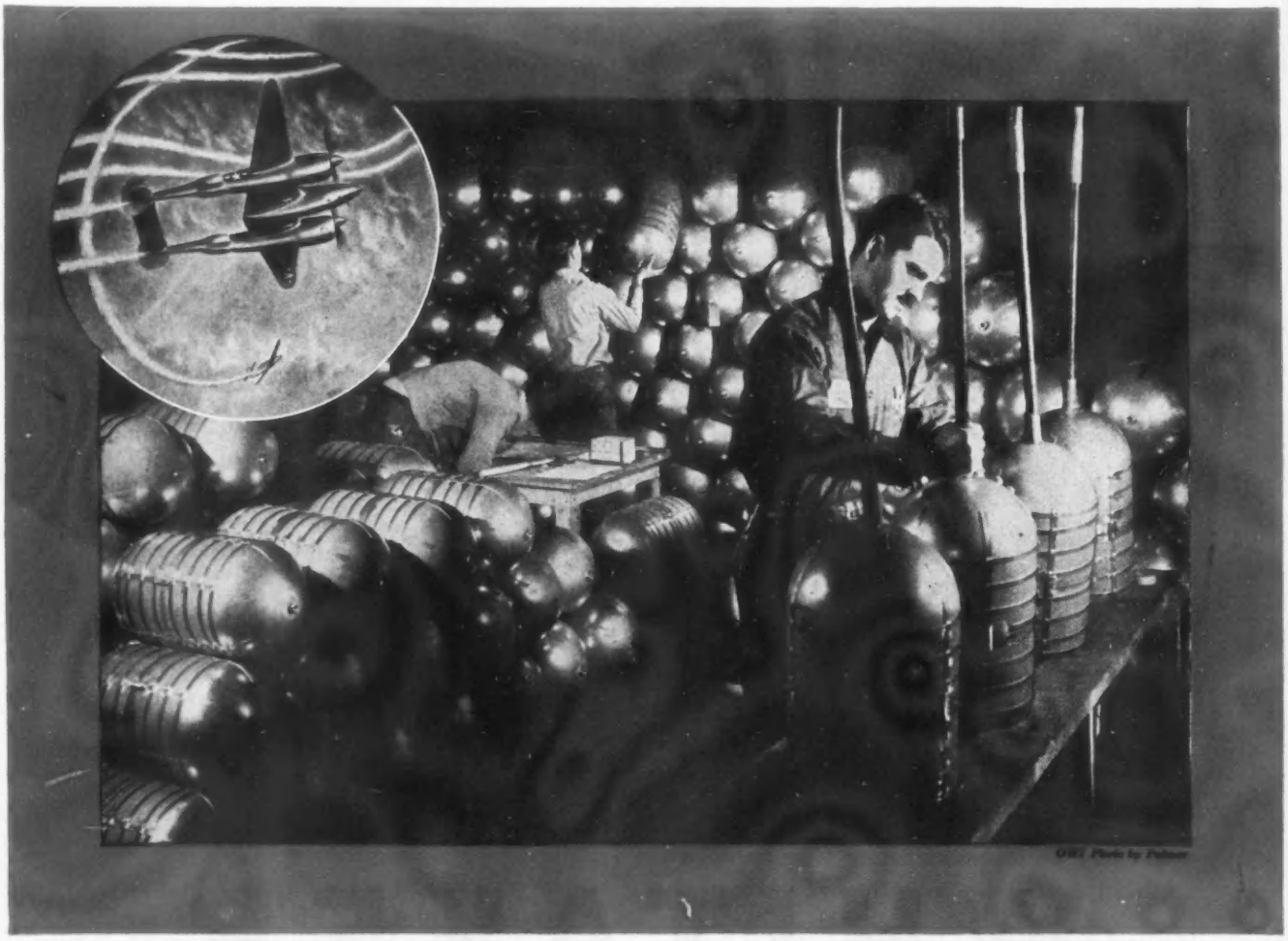

FLYERS' LUNGS OF STAINLESS STEEL

America's bomber and fighter planes often operate as high as 8 miles above the earth. At such heights flyers must have additional oxygen. So, they wear masks connected to oxygen cylinders of stainless steel—a large percentage of which is Republic ENDURO.

This remarkable metal is a Republic Electric Furnace Steel.

It provides the high strength necessary to hold oxygen at a pressure of 400 pounds per square inch with an extremely low weight ratio. It is famous for its resistance to corrosion and other deteriorating conditions. Its exceptional toughness combines with the reinforced design of the oxygen cylinder to protect pilots and their crews by preventing shattering when pierced by a bullet or shell fragment.

All Republic Electric Furnace Steels—like ENDURO—are "targeted steels"—aimed by the accurate control possible *only in electric furnace melting* to hit narrow product and processing specifications—*consistently.*

They are as CLEAN and SOUND as broad experience and the most expert furnace practice can make them. They are *consistently* uniform—in physical, chemical, workability, hardenability and performance values. Their homogeneity means fewer rejects at final inspection, less wasted material, lower production costs. Their freedom from variables effects maximum efficiency in mass production.

YOU need not make oxygen cylinders to appreciate the advantages and economies of Republic Electric Furnace Steels. There may be many places in YOUR peacetime products where these steels will improve salability and profits. Ask a Republic metallurgist. He can tell you—promptly.

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—Leader in the Production of
ELECTRIC FURNACE STEELS
"QUALITY" steels . . . alloy . . . stainless

NOTHING TO SIT ON...

Look at the girl in the top picture. That's how it feels to ride on *Foamex:* more like floating than sitting!

This delightful foamed latex banishes the Sittin' Fidgits, also known as travel fatigue. First, it cradles passengers on millions of air-breathing cells, each a tiny air-valve shock absorber that swallows up vibration and bumps. Second, it prevents cramped muscles by refusing to pack down hard under weight.

Foamex, you see, is soft *and* resilient, all the way through, *both* in one molded material: a logical combination that not only ups comfort, but downs seating maintenance. For seats with no springs to sag, no padding to lump, are bound to hold their shape longer. *Foamex* seats are proving that right now, on highway, railway and airway.

Naturally all *Foamex* production today is for fighting the war. When peace comes remember *Foamex* means victory over travel fatigue and seating upkeep.

P.S. The ideal covering for Foamex *seats* — Velon* *upholstery fabric. Makes smarter colors practical!*

*TRADE MARK

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE by **Firestone**

AN AMP Solderless WIRING DEVICE FOR EVERY AVIATION REQUIREMENT

DIAMOND GRIP INSULATION SUPPORT TERMINALS

The AMP Diamond Grip Insulation Support Terminal combines full protection for wire and insulation, light weight, short compact construction, maximum electrical and mechanical characteristics, quick one-operation installation, and visual inspection of every finished connection. Available for Aircraft and Commercial Wire Sizes #26 to #10 inclusive.

PRE-INSULATED

DIAMOND GRIP INSULATION SUPPORT TERMINALS

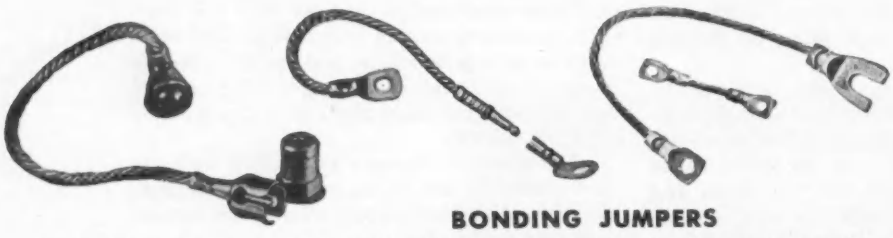
Combines all Diamond Grip features plus pre-insulation. No insulation sleeving is required. The insulation is bonded to the terminal — it will not slip and cannot be accidentally removed. Wire Sizes are quickly identified by color — Red for 22-18 and Blue for 16-14. AMP Precision Press Dies are marked with an identifying disc of the same color as the terminal which they will crimp.

SPLICING TERMINALS

The AMP Splicing Terminal eliminates stocking more than one item —there are only two identical parts. Knife-switch wiping action affords quick, positive splice and four surfaces of direct contact assure maximum conductivity through coupling. The splice holds until intentionally taken apart. The tensile strength of the splice is greater than that of the wire itself. Insulation sleeving slips on easily and is held firmly in place by the contour of the assembly.

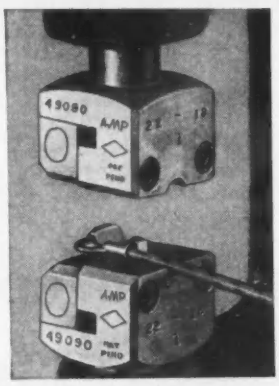
STANDARD (TYPE B) TERMINALS

The AMP Standard Type B line includes a complete range of Solderless Connectors, Contacts and Plugs, design-engineered for (1) Corrosion resistance: All AMP solderless wiring devices are hot-electro-tinned. (2) Flexibility and Strength: Dead soft copper, fully annealed after fabrication. (3) Visual Inspection: The finished connection is readily visible. (4) Crimping Operation: Hand installation tools and press dies are designed to enable even unskilled operators to make uniform, perfect connections quickly.



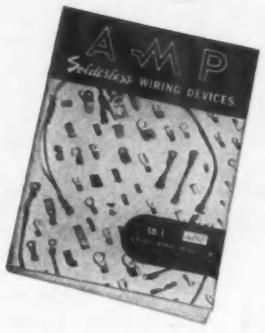
BONDING JUMPERS

AMP has a complete range of Standard and Quick Disconnect Bonding Jumpers to meet the extremely rigorous requirements of both military and commercial aircraft. AMP Bonding Jumpers assure maximum electrical and mechanical efficiency with least weight.



MASS PRODUCTION PRESS DIES

AMP Precision Dies for foot or power operated presses assure maximum uniform high-speed production. Dies are built for long life with all wearing parts of hardened and drawn tool steel, machined to close tolerances. Wire sizes are clearly stamped in both Aircraft & Commercial, and Navy Shipboard designations. Terminal type and die catalog number also clearly marked. The entire crimping operation is completed in 28/100 of a second with AMP Power Press Dies — and every crimp is the exact duplicate of the one before.



A copy of fileworthy new Catalog SD-1, designed to be your handy working tool, is available to you on request. Write today.

AIRCRAFT-MARINE PRODUCTS INC.
AMP
SOLDERLESS WIRING DEVICES

"Precision Engineering Applied to the End of a Wire"

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A&M ACCESSORIES, TORONTO, ONTARIO, CANADA

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Something New
HAS BEEN ADDED TO THE
HANSEN LINE

IN LINE WITH OUR POLICY of keeping a step ahead of the times, Hansen engineers have developed four new airline equipment items, each of which fill a long felt want.

HANSEN ACETYLENE COUPLING comes complete with socket and plug. Socket has left hand thread and plug has left hand swivel nut on one end. Easy to install, easy to operate. Slight movement of the sleeve is all you have to do in order to connect and disconnect. When connected, gas is automatically turned on and coupling is absolutely leakproof. When disconnected gas is automatically turned off. No wastage of gas.

HANSEN ACETYLENE HOSE CLAMP has two grips instead of one, inside and outside of hose. Easy to install, requires no special tools and can be used many times over. Swivel nut has left hand thread.

HANSEN OXYGEN COUPLING consists of socket and plug. Socket has right hand thread and plug comes with right hand swivel nut on one end. Easy to install, easy to operate, slight movement of sleeve is all that is required to connect and disconnect. When connected oxygen is automatically turned on. When disconnected oxygen is automatically turned off. Coupling is absolutely leakproof.

HANSEN OXYGEN HOSE CLAMP has two grips instead of one, inside and outside of hose. Easy to install, requires no special tools and can be used many times over. Swivel nut has right hand thread.

THE HANSEN MANUFACTURING CO.

1786 EAST 27th STREET • • • • CLEVELAND, OHIO

The ELLIPTOID (crowned) tooth form removes the greatest single cause of gear tooth failure—"end bearing." Although the crown or difference between end and center tooth thickness can be varied to suit each application, the recommended amount is .0003″ to .0005″ per inch of face. This is sufficient to prevent disastrous stresses at the most vulnerable point of the tooth—its end.

Gears with ELLIPTOID teeth withstand considerably heavier loads and have a much longer service life than gears with conventional teeth. Or, for the same torque load, gear weight can be materially reduced when the ELLIPTOID tooth form is used. Such economy will be a significant factor in meeting postwar competition.

Red Ring Gear Shaving Machines produce the ELLIPTOID tooth form without special cutters or additional machine time, and in addition, correct errors in index, helical angle, tooth profile, eccentricity and undersirable tooth roughness.

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FOR DESCRIPTIVE BULLETIN

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5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

CONTINUOUS CUTTING MEANS TOP PRODUCTION

CAPACITY
8"x16" RECTANGULAR
8" DIAMETER, ROUND

The metal cut-off band saw principle, in use on all Wells saws, provides maximum production and economical operation through its continuous cutting action. This featured principle, CONTINUOUS CUTTING, is recognized by engineers as being the chief factor in efficient operation. EVERY TOOTH in the blade band does its SHARE OF CUTTING. No lost cutting contact.

The new Wells catalog will give you complete details on all Wells Metal Cutting Band Saw Products. Write for FREE Copy.

WELLS NO. 8

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THE SIGN OF SERVICE

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METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
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We've been "going around" with pulleys for years

Think of the tremendous amount of driving power that pulleys harness. And combat vehicles or your own automobile couldn't run without the vital pulley operated cooling fan and generator. Yes, that's our business, V Type single and multiple groove spun process pulleys—developed and patented by The Spun Steel Corporation. Quickly accepted, too,—for example, the automotive industry gained new efficiencies and economies with SPUNSTEEL pulleys strength, lightness, balance, and "roller conditioned" belt groove surface.

Now this two star "E" award organization is "at your service." Perhaps V Type pulleys enter your new product plans; or you may be able to employ the SPUNSTEEL engineering ingenuity and fabrication facilities for economical design or redesign of metal parts. Your inquiry is invited.

SEND FOR COMPLETE DATA

QUICK FACTS ON SPUNSTEEL SERVICE

Former bar stock and forged parts for bomb components and other essential war items have been engineered, redesigned and precision fabricated economically from stampings. Facilities include modern fabrication equipment for stamping, drawing, furnace brazing, machine work and complete assembly operations plus a creative and cooperative engineering personnel. It's worth investigating now.

THE Spun Steel CORPORATION

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CANTON 6,
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ARMY E NAVY

YOUR War Bond Purchases Will Speed Victory

Everything

IT TAKES TO MAKE YOUR SCREW MACHINE PARTS

TOUREK'S EQUIPMENT

Tourek's modern plant is equipped with a large battery of the latest model automatic screw machines, with the necessary supplementary equipment and complete tool room facilities.

TOUREK'S INGENUITY

Tourek's Engineering Staff knows how to take the fullest possible advantage of the screw machine process for the automatic production of precision parts.

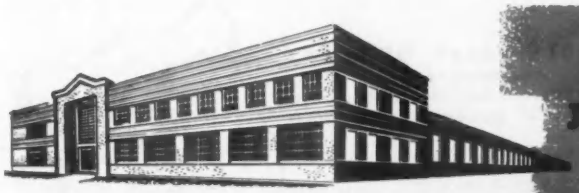
Take it to Tourek!

To supply your precision screw machine parts, Tourek goes to work with resources organized to serve your own special needs. Tourek's modern, complete *equipment*...Tourek's engineering *ingenuity*... and Tourek's long, successful *experience* are coordinated perfectly at every step from blueprint to final delivery. And the results can't help but be right —your parts made *exactly* as you want them.

While we are producing now to the full limit of our facilities, we are eager to be of service. Why not consult us on your postwar screw machine parts problems?

TOUREK'S EXPERIENCE

To the solution of your own special problems Tourek brings to bear a full quarter of a century of successful, volume manufacture of screw machine parts of the most intricate design and precise dimensions.



MAKERS OF THE FAMOUS TOUREK BALL JOINTS

Established 1919

J. J. TOUREK MFG. CO.

PRECISION SCREW MACHINE PARTS

4701-11 West 16th Street Chicago 50, Illinois

MADE IN ACCORDANCE WITH ARMY AND NAVY AERONAUTICAL STANDARDS

• The flyer depends on his instruments—the instruments on a hook-up of fuel, hydraulic and lubrication lines. At every joint and intersection the dependability of Dole Aircraft Valve and Fittings backs up the performance of pilot and plane.

Behind Dole Valves and Fittings stands the experienced Dole engineering and production staff, working for war and planning for the day when they will be called upon to solve YOUR problems.

DOLE

THE DOLE VALVE COMPANY
Established 1906
1901-1941 Carroll Ave., Chicago 12, Illinois
Los Angeles • Detroit • Philadelphia

Freedom is Beyond Price. Buy it on a Profit Sharing Basis with U. S. War Bonds

AIRCRAFT VALVES and FITTINGS

VERNIER CALIPER

THIN, HARDENED AND GROUND JAWS FOR MAKING ACCURATE MEASUREMENTS.

INSIDE DIAMETER MEASURING JAWS FORM SINGLE POINT WHEN CLOSED.

VERNIER READS DIRECT TO .001 IN. HAS THUMB CONTROL FOR JAW SLIDE.

VERNIER ADJUSTMENT SCREWS ALLOW EASY CLEANING AND RESETTING.

ALL WORKING SURFACES ARE HARDENED, GROUND AND LAPPED.

ENGRAVING CLEAR, READABLE AND ACCURATE.

6 IN. DEPTH PROJECTION ROD WITH RELIEVED POINT. READ SCALE DIRECTLY FOR MEASUREMENT.

VARD is glad to announce that its precision-built Vernier Caliper is now available for general sale.

This is a pocket type instrument, measuring a full 6 inches inside or outside measurement. In addition, it has a 6 inch depth projection rod with relieved point which is read directly on the face scale of the tool.

This VARD caliper has a Vernier with thumb control which permits accurate measurements to .001 of an inch.

Engraving is clear, readable and accurate. All working surfaces are hardened, ground and lapped.

Write for descriptive literature and price sheet.

ARMY E NAVY

PASADENA 8, CALIFORNIA

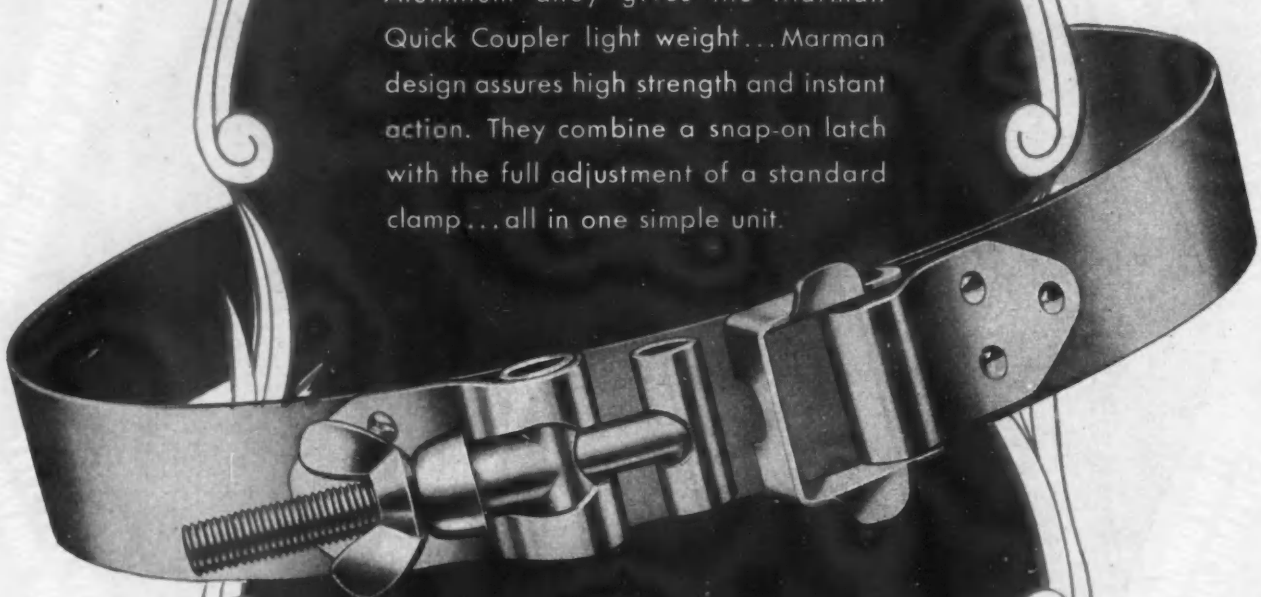
VARD INC.

MARMAN'S

Aluminum Alloy

QUICK COUPLER

Aluminum alloy gives the Marman Quick Coupler light weight... Marman design assures high strength and instant action. They combine a snap-on latch with the full adjustment of a standard clamp... all in one simple unit.



Marman Quick Couplers are particularly suited to the handling of removable equipment, such as oxygen containers, fire extinguishers, duct sections, etc. Sizes and shapes to fit any convex surface, with wing, hex or self-locking nut.

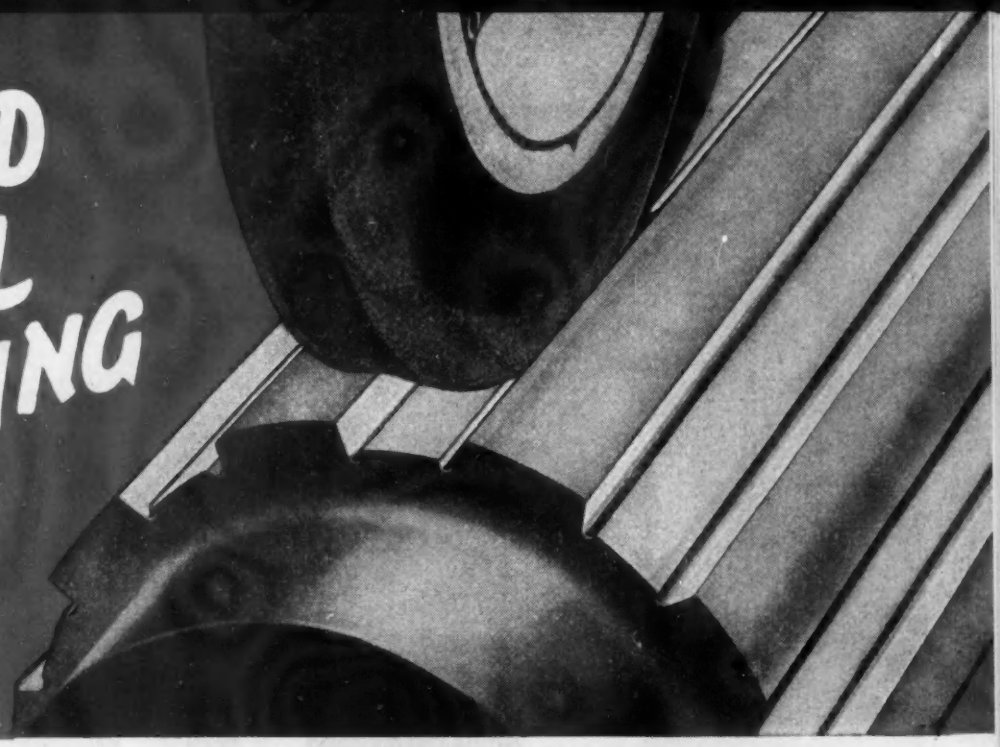
New Engineering Catalog now available to Industry Personnel

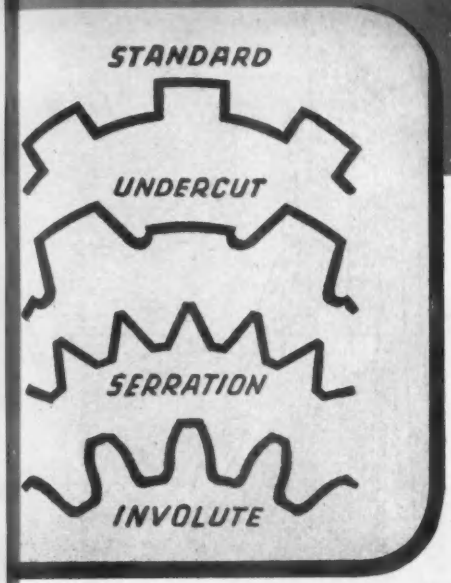
MARMAN clamps

MARMAN PRODUCTS CO. Inc.

940 WEST REDONDO BOULEVARD
INGLEWOOD, CALIFORNIA

FORMED WHEEL GRINDING





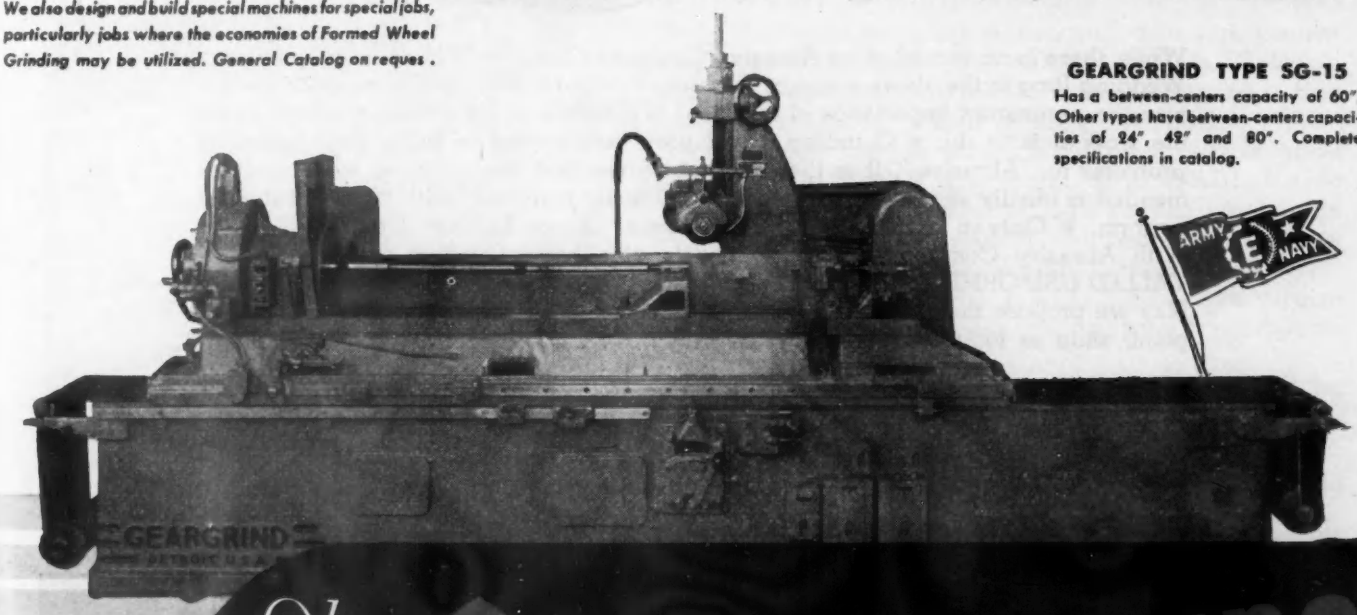
EXTERNAL SPLINES and SERRATIONS

GEARGRIND Machines grind production runs economically, while retaining the close tolerances demanded by your engineers. In producing spline gauges and spline broaches, where extreme accuracy and high finish are required, GEARGRIND Machines are tops. May be equipped with adjustable micro table stop, for grinding splines of cramped design or blind spline runout.

Sound engineering, painstaking craftsmanship, semi-automatic operation and smoothness characterize these machines. They employ the same type of low pressure, hydraulic system used in the complete line of GEARGRIND Machines in the formed wheel grinding of external and internal gears, external, and internal involute splines, straight splines, serrations and racks.

We also design and build special machines for special jobs, particularly jobs where the economies of Formed Wheel Grinding may be utilized. General Catalog on reques .

GEARGRIND TYPE SG-15
Has a between-centers capacity of 60". Other types have between-centers capacities of 24", 42" and 80". Complete specifications in catalog.



The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

With This Ring I Thee Wed*

While there is no record of an Abrasive Company Grinding Wheel being used as a Wedding Ring in the above manner, Abrasive Company Service Engineers do recognize the paramount importance of the ideal WEDDING of the grinding wheel—with the work it is to do. ★ Grinding wheel users are invited to bring their grinding problems to "Abrasive." It is then our job to see that the grinding wheel recommended is ideally suited—and therefore, "perfectly matched" with the work it must perform. ★ Only in this way can the result be a "Happy Ending" for all concerned. With Abrasive Company Grinding Wheels, this happy ending embraces UNRIVALLED UNIFORMITY, UNMATCHED PERFORMANCE, and UNUSUAL ECONOMY. May we propose that you let "Abrasive" products convince you right in your own plant, shop or toolroom? Your inquiry will receive prompt and friendly attention.

TRADE ABRASIVE MARK REGISTERED

* *On the Isle of Man great stone rings several feet in diameter have been used as wedding rings. As part of the legal wedding ceremony the bride and groom shook hands through the large hole in the middle.*

TRADE ABRASIVE MARK REGISTERED

COMMANDING QUALITY . . . OUTSTANDING RESULTS

ABRASIVE COMPANY

DIVISION OF SIMONDS SAW AND STEEL CO.

TACONY & FRALEY STS., PHILADELPHIA, PA. • DISTRIBUTORS IN ALL PRINCIPAL CITIES

Only the best in ships, personnel and equipment has ever been good enough for P.C.A. Nothing else can account for the marvelous record it has made—particularly that of the past year.

Only the best in servicing equipment is good enough too. That's why you'll find HALL Valve and Valve Seat Servicing Equipment in use by P.C.A. and other transport companies; why it is so widely used by the armed forces of our own and allied nations; why HALL production equipment has been so universally adopted by airplane engine manufacturers.

HALL Valve Servicing Equipment gives the finest precision and finish and does it faster . . . Write for complete information.

The Hall Manufacturing Co. • Toledo 7, Ohio

HALL

What's a .50 calibre cartridge link got to offer for the future?

SIMPLY this—it offers a definite promise of greater efficiency, greater durability and better performance in all peacetime products made of American Quality Cold Rolled Strip.

That seems like a large order, but in these war years we've learned a lot of new things about making cold rolled strip steel. For example, the exacting specifications set up by Uncle Sam for these cartridge belt links has called for unusual metallurgical knowledge and technical skill. The enormous tonnages involved have required manufacturing facilities far beyond the ordinary.

These links that tie the bullets together must race through a .50 calibre machine gun at the rate of 800 shots a minute. The gun will jam unless each link is uniformly perfect. That unfailing uniformity has to start with the steel strip from which those links are made.

Every pound of American Quality Cold Rolled Strip we furnish for bullet links must be within very close tolerances in chemical analysis, structure, dimensions, finish and straightness. Otherwise, subsequent forming operations and heat-treating would fail to produce perfect links.

To impart perfect workability, the steel for these links is bright annealed in furnaces of special and improved design. Thus, the fabricator can set his dies and machinery for top-speed production with full confidence of getting the precise results desired.

Fabricators have done an outstanding job in producing so many of these links so quickly. It has been our privilege to supply most of the fabricators with American Quality Cold Rolled Strip Steel. Its ability to fit new and unusual requirements will serve you well in your "Products of Tomorrow."

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS AMERICAN *Quality* COLD ROLLED STRIP

UNITED STATES STEEL

PRELUDE TO VICTORY

We have come a long way since the dark days of Pearl Harbor. Beset with overwhelming difficulties but steadfastly resisting hurried and unprepared action, America has carefully planned and produced for our armed forces better and more abundant mechanized equipment than the world has ever before seen assembled for the defense of a united people.

Myriads of bearings with shafts revolving at tremendous speeds are involved in this mechanized equipment. And the bearings must be adequately protected—the life-sustaining lubricant kept from seeping out, and dangerous outside matter—dirt, dust, grime, water kept from getting in. Milpaco Oil Seals do this important safeguarding job. They are used in Aircraft, Trucks, Tractors, Landing Craft and other mechanized equipment. They are also used to protect bearings in the many peacetime mechanisms which one day will again add to the comforts of mankind. And while our energies are now diverted toward producing the vast quantities of Milpaco Oil Seals needed for the weapons of invasion, we are trying to take care of our old customers and shall give your inquiries for current needs as well as for future planning every possible consideration.

MICHIGAN LEATHER PRODUCTS COMPANY

6317 East Lafayette Ave., Detroit 7, Mich.

You Can't Fail Them Now!

BACK THE 5th WAR LOAN TO THE LIMIT

MILPACO *Oil Seals*

PORTRAIT OF A HERO
...handle with care!

Many a wounded hero will come home well and strong again, thanks to a thin sheet of film...

Thanks to the miracle of the X-Ray . . .

And thanks to air conditioning and refrigeration which help make the miracle possible! *Air conditioning* supplies clean, filtered air — with accurate regulation of both temperature and humidity — in plants where X-Ray film is made, in army hospitals where it is used. *Refrigeration* cools the solutions used in processing the film.

Out of such wartime applications, General Electric is evolving new techniques, finer equipment for conditioning temperature and humidity. When equipment again is available for peacetime commercial and industrial uses, it will be vastly improved — more compact, more efficient, more flexible than ever before!

Now . . . we'll be glad to put your name down for *earliest available* data on postwar air conditioning and refrigeration equipment. Write: *General Electric Co., Air Conditioning and Commercial Refrigeration Divisions, Section 426, Bloomfield, N. J.*

☆ BUY WAR BONDS ☆

Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays 10 P. M., EWT, NBC..."THE WORLD TODAY" News, Every Weekday, 6:45 P. M., EWT, CBS

BASIC DESIGN ASSURES STEERING EXCELLENCE...LONG SERVICE

GEMMER STEERING

Note the basic design of the Gemmer Steering Gear. An hourglass worm engages gear teeth that *roll*. Anti-friction bearings are placed at all critical points. Absence of sliding friction provides highest efficiency—easiest transfer of power—easy steering with plenty of power for parking.

Design and construction are also exceptionally sturdy and compact—providing abundant strength, long endurance—ease of installation—saving of weight without sacrifice of overall capacity or steering arm angularity. Alloy steel forgings provide ample safety factor. Internal stresses are low.

A Gemmer Steering Gear will last, and *give satisfaction* for the life of the vehicle.

Simple:—Just a few parts—nothing complex—nothing to get out of order or require frequent adjustment.

Stable:—No "lost motion"—wear reduced to least possible minimum. Steering is always firm, responsive, positive with absence of rubbery feeling and—wander.

Gemmer Steering is demonstrating its worth in every type of automotive vehicle from the lightest passenger cars to the heaviest buses and trucks—in the road-building machinery, agricultural tractor, and marine fields.

GEMMER
MANUFACTURING COMPANY
6400 MT. ELLIOTT
DETROIT 11, MICH.

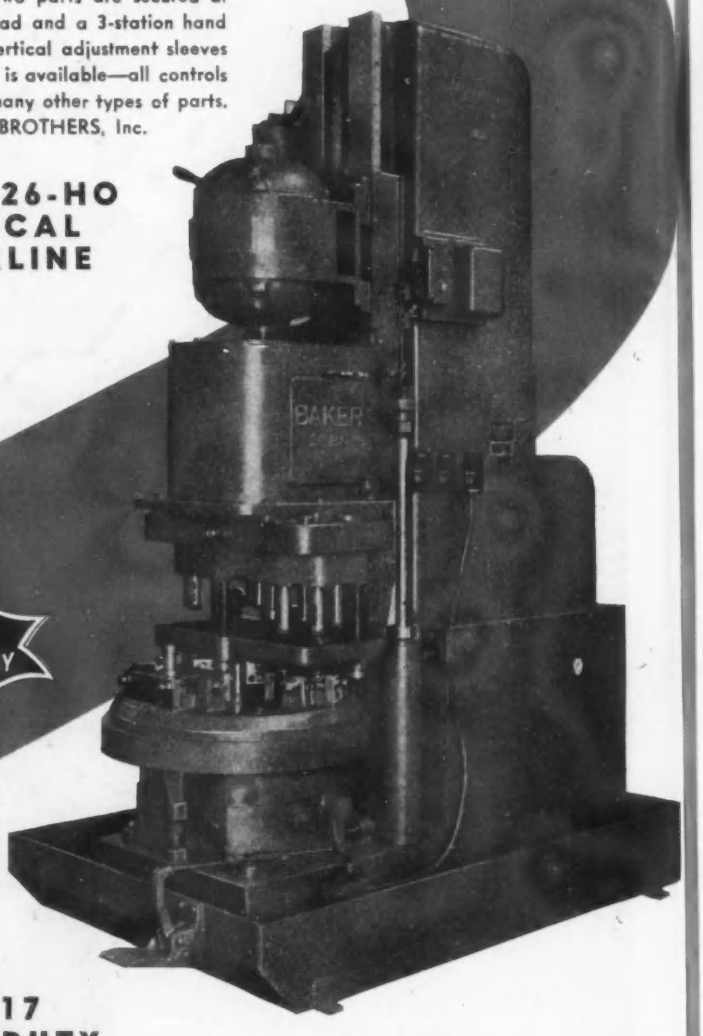
GEMMER . . . Pioneer of Efficient Steering

BAKER *Offers Both!*

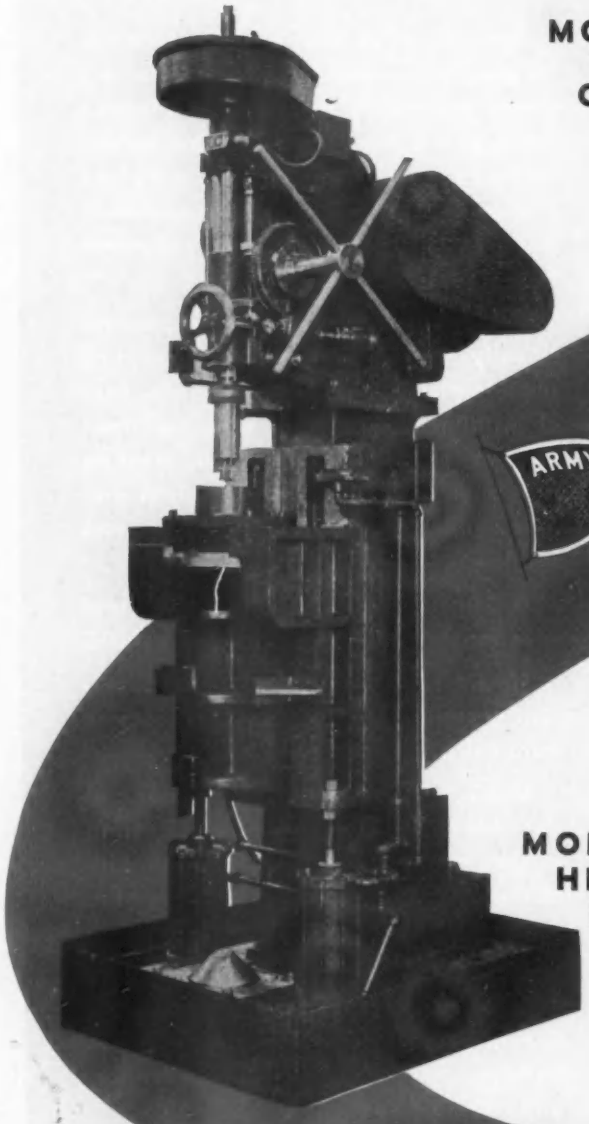
★ Mechanical Geared Feed Machines
★ Hydraulic Feed Machines

• RIGHT: Model 26-HO Vertical Clearline. This versatile BAKER Machine is illustrated as set up for operations on guides used on tanks. Drilling operations are handled at the left cutting station, reaming operations at the right cutting station. Two parts are secured at each cycle. • This machine has a special 8-spindle fixed center head and a 3-station hand index table. The spindles are all mounted on ball bearings, with vertical adjustment sleeves in each spindle end for seating of tools. • A wide range of speeds is available—all controls are convenient to the operator. Readily changed over for work on many other types of parts. Special fixtures and special multiple head are furnished by BAKER BROTHERS, Inc.

MODEL 26-HO VERTICAL CLEARLINE



ARMY E NAVY



MODEL 217 HEAVY DUTY DRILL

LEFT: Arranged with holding fixture and increased clearance to accommodate 500-pound bombs. With extra adapters, 1000-pounders can be handled. Operations include: 1—Drill from solid. 2—Rough coredrill and rough face. 3—Finish ream and face. 4—Tap. These operations are done on individual machines, rechucking for each operation.

BAKER BROTHERS, INCORPORATED, TOLEDO 10, OHIO

BAKER

What the Reproduction World has been waiting for!

Never before has there been a dry developing paper like OZALID RAPID BLACK.

You'll be convinced of this when you try it in your Ozalid Whiteprint Machine.

You can use RAPID BLACK with all your originals. You can operate your machine at top speeds . . . and these results are *guaranteed:*

1. . . . *"Quality" prints* from your pencil tracings.
2. . . . *closest facsimiles* of your typewritten material.
3. . . . *excellent reproductions* from positive film transparencies of your photographs.
4. . . . *exceptional contrast* between line detail and background—opaque *black* on a *new* white.

ACCEPT THIS FREE OFFER

Try new OZALID RAPID BLACK in your machine, using your originals. We'll gladly send you a package FREE.

P.S. —If you haven't an Ozalid machine, send for free printed samples . . . and our illustrated booklet which explains the Ozalid Process.

OZALID PRODUCTS DIVISION

GENERAL ANILINE & FILM CORPORATION
Johnson City, N. Y.

Gentlemen:

☐ Send a FREE package of your new paper, OZALID RAPID BLACK, for use in our Ozalid machine.

☐ Send printed samples and a copy of SIMPLIFIED PRINTMAKING.

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Company_____ Title_____

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ANOTHER, another in the steady stream of Independent Mobile Oxygen Generators is on its way to our fighting forces... *somewhere* on the world Battle Fronts... supplying oxygen to our "*hi-flying*" air squadrons who could not leave the ground without their oxygen tanks filled. • • Independent... *first* to produce these Mobile Oxygen Generators—First Too in actual service—You'll find Independent Engineering Company *first*—after Victory —to supply *you* with equipment for producing industrial gases for peace-time pursuits.

Independent Engineering Co.—Pioneer designers and producers of Mobile Oxygen and Hydrogen generating plants for the armed forces... builders of Oxygen, Hydrogen and Acetylene plants —manufacturers of industrial gas cylinders and cylinder handling equipment.

ARMY E NAVY

INDEPENDENT ENGINEERING CO.

O'FALLON INCORPORATED ILLINOIS

The DATA on TODAY'S STEELS that you've been waiting for

EVER since the new emergency compositions were introduced, plant technicians and materials engineers have been asking for exact and dependable data on the properties of wartime carbon and alloy steels. Now, after much experience in making and treating these steels, and more than a year of intensive testing and research, the information is available in this newly-published book.

Called "Properties of Frequently Used Carbon and Alloy Steels," the book contains 100 pages of vitally needed information on today's steels —data based on hundreds of actual tests conducted by Bethlehem metallurgists. Guesswork has been eliminated; with the charts, graphs, and drawings in front of him, the man who uses or specifies steel can tell at a glance the physical properties of leading carbon and alloy steels, including the more popular NE grades, in various conditions of heat-treatment.

In addition, the book contains detailed, practical information on such topics as Grades of Steel; Case and Core Properties of Carburized Steels; End-Quench Hardenability; Quenching Media, Spectrographic Analysis, and numerous other subjects.

If you use or specify steel you will want to keep a copy of this new, useful book right on your desk or within easy reach. Write for a free copy today, on your company letterhead.

BETHLEHEM STEEL COMPANY
GENERAL OFFICES: BETHLEHEM, PA.

Bethlehem Steel Export Corporation
New York

BETHLEHEM STEEL

PROTECT the crank pin bearing, main bearings and gibs on your punch presses

LINCOLN

CENTRO-MATIC LUBRICATING SYSTEMS

Available in Complete Kits for Standard Punch Presses

Save man hours . . . machine hours . . . bearings . . . power—and reduce accidents by equipping your machines with Centro-Matic Lubricating Systems.

Lincoln Centro-Matic packages include 5, 7, 9 or 11 injectors, lubricant pump, tubing, brackets, bolts, fittings and complete illustrated instructions—everything to make the installation. They are easy to install. No special tools are needed. Ask the nearest Lincoln Distributor for details, or write us.

EASY TO INSTALL

★ ★

EASY TO OPERATE

144-9

Do more than before—BUY EXTRA BONDS in the 5th WAR LOAN

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LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

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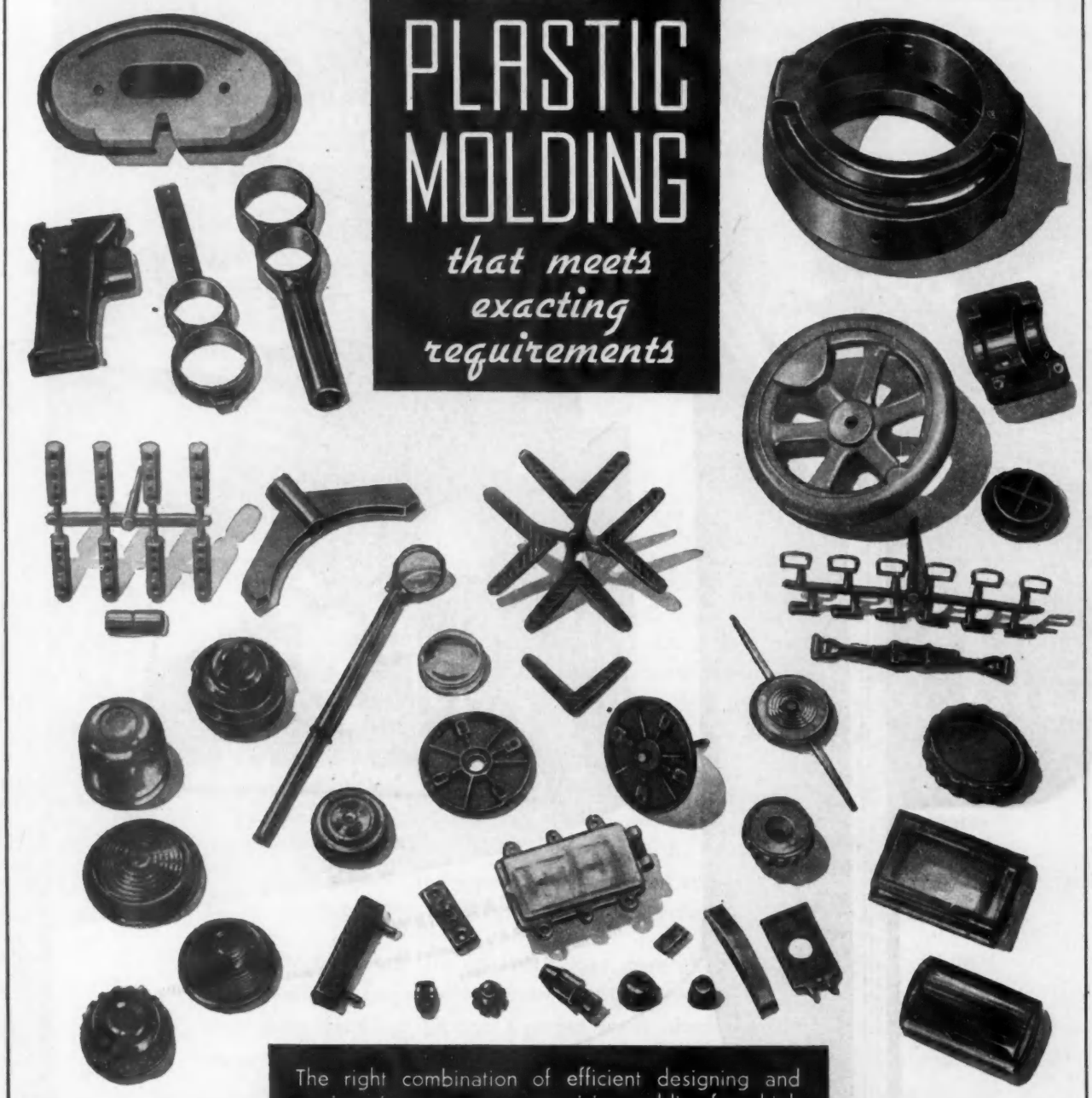
Precision

PLASTIC MOLDING

that meets exacting requirements



The right combination of efficient designing and engineering assures you precision molding from high quality thermoplastic materials. Your exacting requirements are met promptly, efficiently and accurately, from small intricate designs to large 18 oz. moldings. Complete complementary equipment to answer your demand for plastic moldings, including complete dash panels, garnish moldings and similar trim.

Due to the allocation control of plastic materials, our production is at present restricted to direct war and essential civilian work.

Buy WAR BONDS

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PLASTIC DIVISION

PAN AMERICAN AIRWAYS

"Pop" Eubanks, PAA's Propeller Shop Chief eases his responsibility by Magnaflux Inspections

FROM the close contacts enjoyed by the Magnaflux Corporation with industrial concerns, it seems that a company's inspection methods are a reliable index of the *quality* of its products, or services.

Magnaflux Methods—for magnetic or non-magnetic materials—permit the rapid examination of *every part* for flaws, foreign inclusions, fatigue cracks or other weaknesses. Failures can be forestalled before assembly or during overhaul. Their cause can usually be corrected. The highest percentage of perfect parts can be maintained.

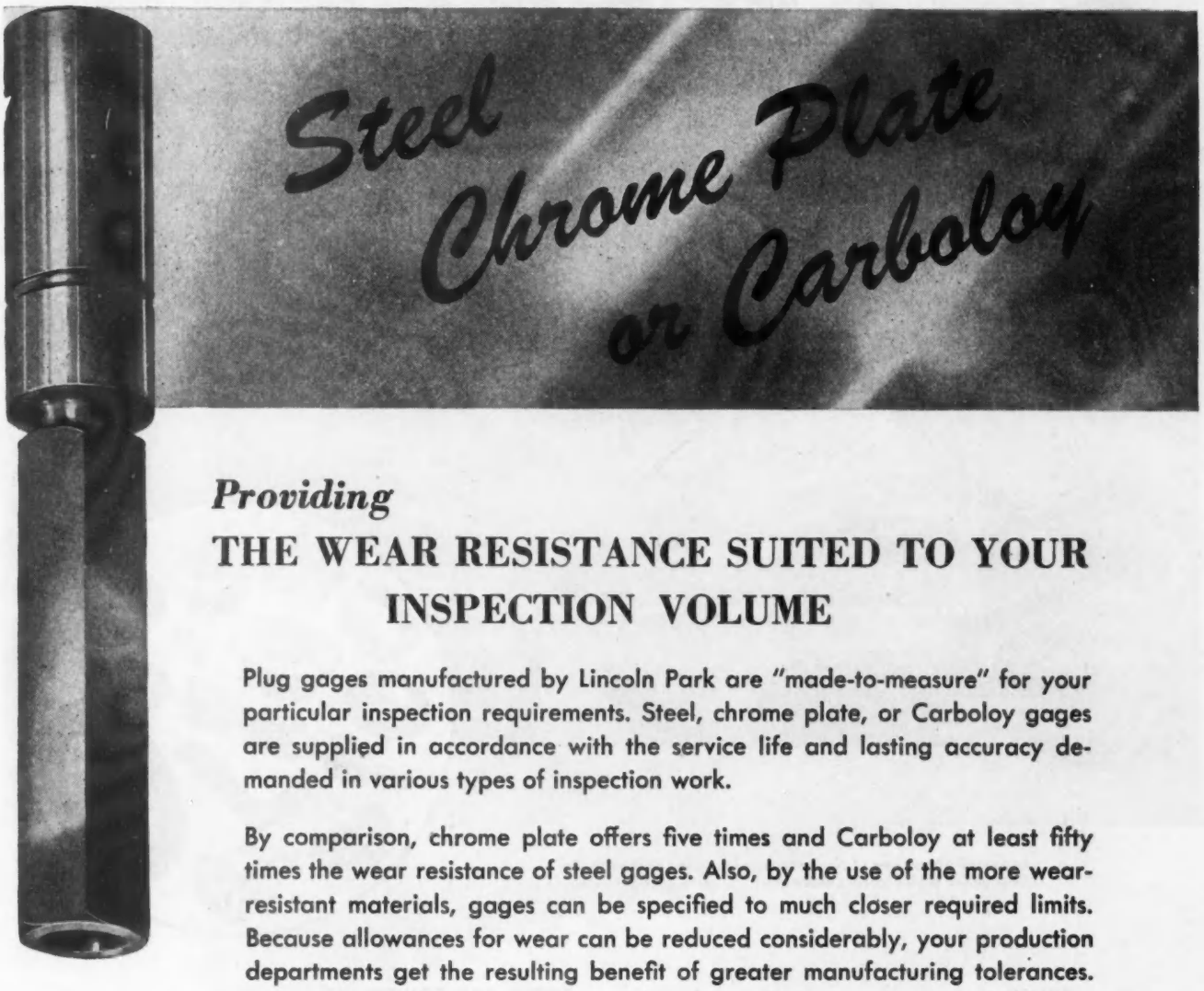
This is *quality* exactly as most reputable concerns strive for it. Let us explain how Magnaflux Inspections help.

MAGNAFLUX CORPORATION

5904 Northwest Highway, Chicago 31, Illinois

New York : Detroit : Dallas : Los Angeles : Cleveland : Birmingham

PLUG GAGES...IN ANY OF 3 MATERIALS



Providing

THE WEAR RESISTANCE SUITED TO YOUR INSPECTION VOLUME

Plug gages manufactured by Lincoln Park are "made-to-measure" for your particular inspection requirements. Steel, chrome plate, or Carboloy gages are supplied in accordance with the service life and lasting accuracy demanded in various types of inspection work.

By comparison, chrome plate offers five times and Carboloy at least fifty times the wear resistance of steel gages. Also, by the use of the more wear-resistant materials, gages can be specified to much closer required limits. Because allowances for wear can be reduced considerably, your production departments get the resulting benefit of greater manufacturing tolerances.

In the production of Lincoln Park gages, careful control in grinding and lapping produces gages with extremely high finish—a guarantee of maximum inspection life. Class XX and X gages are finished with Profilometer readings no greater than 1.5 microinches. Readings no greater than 2.5 microinches are guaranteed on Class Y gages.

Prompt delivery of any type of plug gage you require can be promised by Lincoln Park. See your Lincoln Park sales representative or write directly to the plant.

BUY MORE THAN BEFORE in the 5th WAR LOAN

ARMY E NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1727 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN

Above view shows one of the batteries of molding presses in the ORCO plant which covers more than 11 acres of floor space.

Plans—*YOUR plans*—for the use of rubber or synthetic rubber may involve one or a combination of services and facilities all readily available at The Ohio Rubber Co.

RESEARCH: An experienced staff of field research engineers is prepared to cooperate with you on any problem of mechanical molded or extruded rubber *and ANY type of synthetic rubber.*

LABORATORY: A complete staff of laboratory technicians is fully equipped with modern facilities to expedite solutions to your problems.

MOLD ENGINEERING: Activities of this department are centered on the design and production of high quality molds together with the design of special molding presses where necessary.

TOOLS AND EQUIPMENT: This department specializes on the design and construction of all tools and equipment required for efficient production.

FACTORY FACILITIES include modern molding and extruding equipment for producing your small or large volume requirements under a system of FACTORY CONTROL that assures highest efficiency. Special processes and equipment for bonding rubber and synthetic rubber to metal and other materials are an important part of "ORCO" facilities.

INSPECTION AND TESTS are the responsibilities of another highly specialized department equipped with many special testing machines designed by ORCO engineers.

Refer your problems in rubber and synthetic rubber to "ORCO"— *where plans take shape.*

"ORCO-OPERATION"

THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO

BRANCHES: DETROIT • NEW YORK • CHICAGO • INDIANAPOLIS • WASHINGTON • CLEVELAND

FOR THE BEST DRESSED POST-WAR JOBS

REEVES ARMY TWILL

"FROM COTTON TO CUTTER"

America's leading air transport companies are typical customers for Reeves Army Twill. Whatever the industry, if uniforms are needed, this top-quality fabric tailors smartly and gives superb service. Over 80 million yards of it have already been used to help equip America's fighting men, and it is proving itself under the toughest climatic and combat conditions of global war. This fabric, Sanforized Shrunk* and color-fast to sun, water and perspiration, will meet *your* post-war uniform needs. When the time comes to order them, choose from a wide range of popular colors — insist on getting Reeves Army Twill.

**Residual shrinkage less than 1%*

THE REEVES FABRIC GROUP INCLUDES: *Reeves Army Twill · Glengarrie Poplin · Reeveking Gabardine · Byrd Cloth · Marine Herringbone · Reeves Sateen · Warrior Twill*

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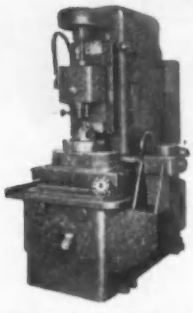
Mills Mill, Greenville, S. C. and Woodruff, S. C.
Fairforest Finishing Co., Spartanburg, S. C.

REEVES BROTHERS, INC.

54 WORTH STREET • NEW YORK 13, N. Y.

Representatives in Atlanta • Boston • Chicago • Dallas • Los Angeles • Philadelphia • St. Louis • Montreal • Toronto

Now is the time to talk to SNYDER about ways and means to control PRODUCTION COSTS!



SNYDER KNOWS HOW

This special-purpose automatic cycle machine, designed and built by Snyder, mills three pairs of slots, each slot connecting two holes, in a gear flange.

Two-spindle head with ball-bearing mounted spindles advances rapidly toward work which reciprocates slowly through an arc the length of the slot. Hydraulic feed moves the tools into the work in small steps of .010″ to .060″ per reciprocation of the part. As each pair of slots is cut, tools retract rapidly, hydraulic feed is automatically reset and the fixture is indexed 60 degrees, bringing the flange into position for the next cycle. Index drive is through splined shaft and worm wheel. Reciprocation of main table is through rack and pinion by means of hydraulic cylinder plungers.

Figures on post-war price tags will be decided by figures on post-war production cost sheets—which in turn will be governed by the efficiency of production machines and of the workers who operate them.

The special-purpose machine offers positive and reliable means for controlling the various processing factors—speed, accuracy, finish, etc.—which govern cost. Designed to perform one or a series of operations which may be simple or complex, it operates upon an automatic time cycle, predetermined by your production objectives. Time is controlled.

Tolerances and finish likewise are predetermined and are maintained uniformly and automatically, minimizing the ratio of rejects and scrap. Quality is controlled.

Automatic operation, by reducing the factor of human skill prevents excessive tool cost. It also increases the safety factor.

Because of these advantages, the special-purpose machine will be a major factor in deciding the figures to be written upon post-war price tags.

The time to plan your machines for post-war production is NOW—while there is time to design and build them BEFORE they are actually needed. Designed now, they can be built as soon as present restrictions are lifted, installed in your production line, ready to go when materials are made available.

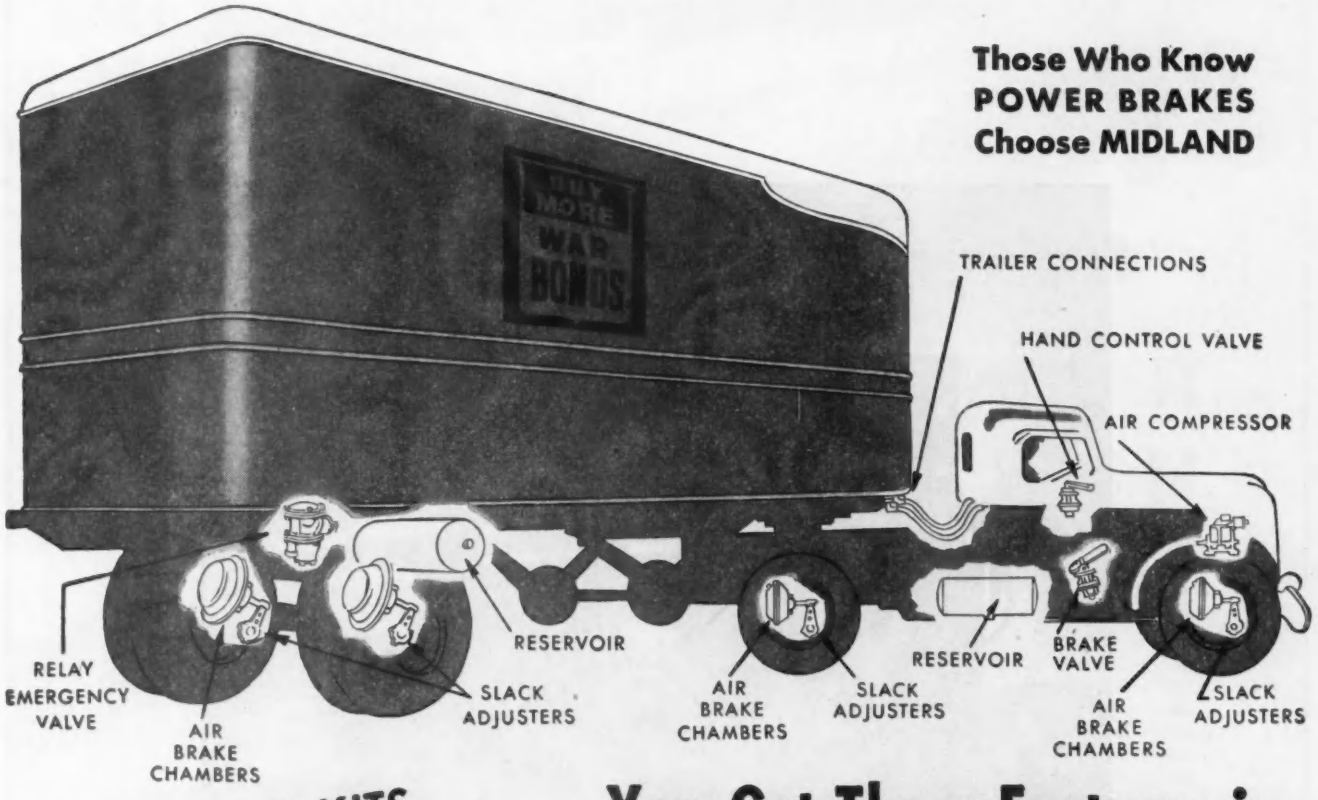
By reason of its 20 years experience in designing and building special-purpose machines, the Snyder organization is particularly well qualified to help with your production problems—and is ready to consult with you on the initial steps NOW. We invite you to write in full confidence. Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.

PLAN Your PRODUCTION
when you
PLAN Your PRODUCT

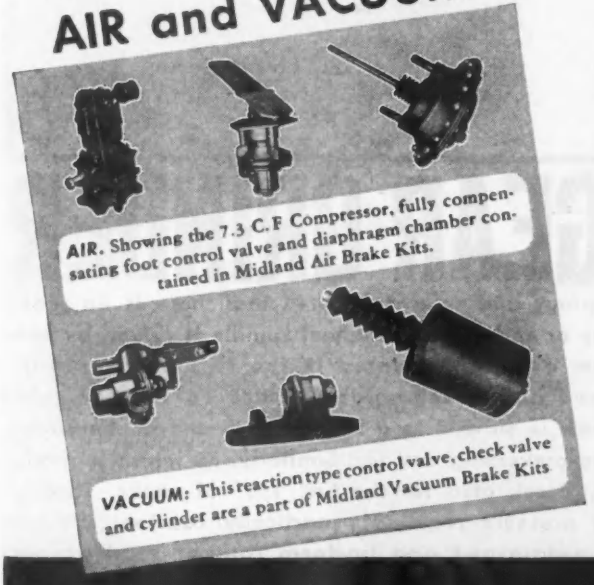
SNYDER
DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST

20 Years of Successful Co-operation with Leading American Industries

Those Who Know
POWER BRAKES
Choose MIDLAND



MIDLAND KITS are available in both AIR and VACUUM



AIR. Showing the 7.3 C.F Compressor, fully compensating foot control valve and diaphragm chamber contained in Midland Air Brake Kits.

VACUUM: This reaction type control valve, check valve and cylinder are a part of Midland Vacuum Brake Kits

You Get These Features in MIDLAND AIR BRAKES

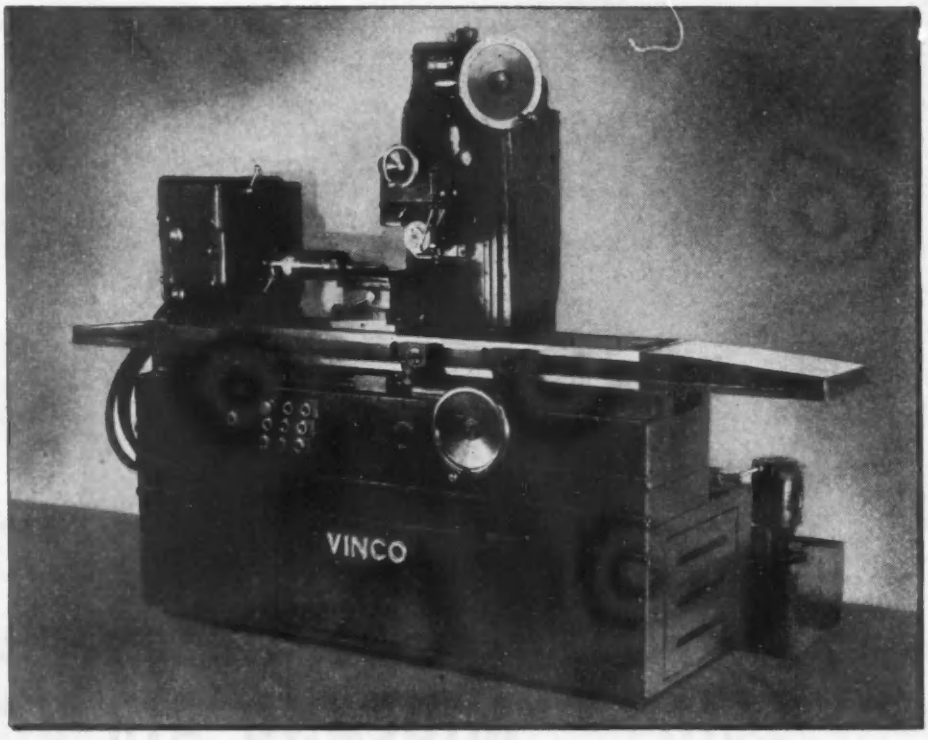
Simplicity in design, thorough engineering and rugged construction are back of the overwhelming preference for Midland Power Brakes.

Midland equipment on your trucks will stop any load quickly, safely, easily—require fewer brake adjustments—reduce driver fatigue.

Midland Power Brakes—in both Air and Vacuum—are backed by our famous "Factory Rebuilt Exchange Plan." And there are Midland distributors to serve you in nearly 150 cities from coast to coast. Ask your distributor, or write to us for complete facts about Midland Power Brakes.

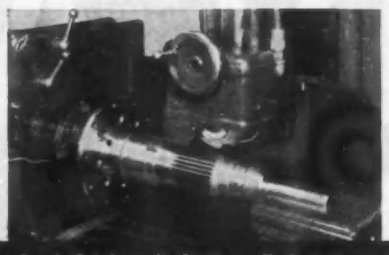
THE MIDLAND STEEL PRODUCTS CO.
10605 MADISON AVENUE • CLEVELAND, OHIO
Export Department: 38 Pearl St., New York City

MIDLAND
CHRISTENSEN
POWER BRAKES



VINCO SPLINE & GEAR GRINDER

Here is a grinder that can safely be termed "super". Semi-automatic, hydraulically controlled, it does a fast, accurate job of grinding splines and gears in production. Wheel dressing and wheel feeding are the only non-automatic operations, and the only adjustment necessary is to compensate for wear of the dresser diamond. Its high degree of accuracy is due to a number of exclusive features—chief of which are the index head and plate, the index spindle, the wheel spindle and the Hydraulic Controls. The work, when indexed, instead of coming to an abrupt stop, is slowed by hydraulic action in the index head and the pawl drops gently into the slot of the master index plate. The plate is made with gage accuracy, being guaranteed accurate to within .0003" accumulated error. The index spindle is mounted in special ball bearings and so closely fitted that there is no radial play or end play. The wheel spindle is driven by belts from a motor mounted in the column. Hydraulic "Feed and Deceleration" valves control the table which is slowed to a stop at each end of the stroke, thus preventing any jar. Similarly, its return is gradually accelerated for the first 1½" of stroke. Through our pressure regulator, practically constant pressure is maintained and uniform rate of feed accomplished. Automatic timing and synchronization of all movements is a tribute to the engineering skill behind this exceptional machine tool. Write for specifications.



VINCO CORPORATION
8869 SCHAEFER HIGHWAY
DETROIT 27, MICHIGAN

MILLIONTHS OF AN INCH FOR SALE BY VINCO

Continental Red Seal Engines

POWER TO WIN

American Flyers are superbly trained. Their intensive training combined with native skill, resourcefulness and initiative, has produced the world's greatest combat fighters.

Continental Red Seal Engines are a very important part of this air force training. At just one of the many fields under supervision of the U. S. Army Air Forces, trainers powered by these famous engines are flying an average of more than 49,000 miles daily. Think this statement over carefully. It means nearly 18,000,000 miles a year.

This is just one of Continental's many contributions in its Power to Win program which will be relentlessly carried through to victory.

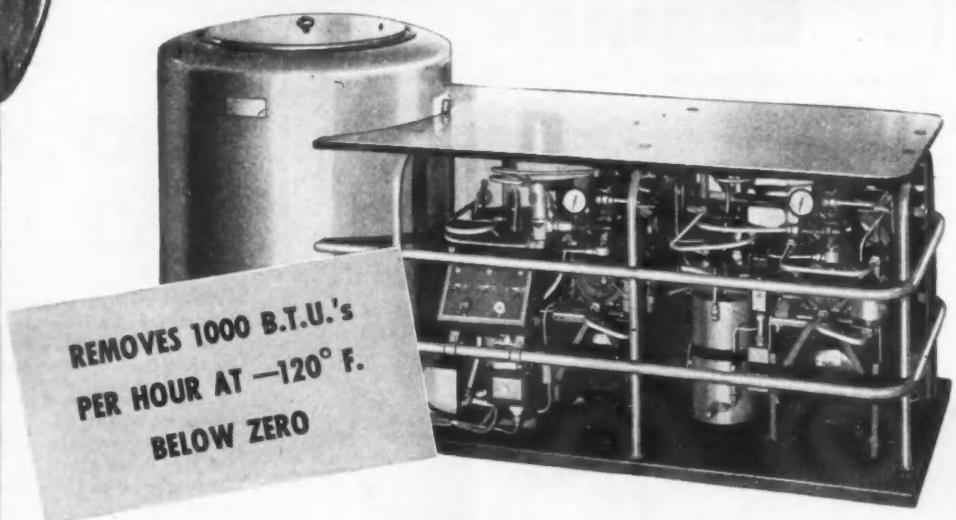
Your Dollars are Power, Too!
Buy War Bonds and Keep Them.

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

Awarded to the Detroit and Muskegon Plants of Continental Motors Corporation for High Achievement

ARMY E NAVY

HOW CAN I USE THE NEW *Deepfreeze* PROCESS OF COLD TREATING IN *MY* PLANT?



Here's what others have to say about cold treating with *Deepfreeze*

A PROMINENT MANUFACTURER OF MILLING CUTTERS says, "By cold treating cutters in a Deepfreeze machine at —120° F. for two hours, we have increased cutter life from 7 to 24 hours per grind."

A BROACH MANUFACTURER writes, "After cold treating high speed burnishing broaches at —120° F. for three hours, an increase of from 216 to 648 pieces per grind was obtained."

A MANUFACTURER OF PRECISION GAUGES states, "We have been able to minimize expansion in precision gauge blocks by treating them in Deepfreeze Industrial Cold Treating Machines. This stabilization eliminates costly metal growth and warping which formerly destroyed accuracy."

A MANUFACTURER USING DEEPFREEZE FOR SHRINK FITS comments, "The Deepfreeze Cascade —120° F. Industrial Chilling Machine saves us from $3000 to $4000 per month over use of liquid air in assembling piston bushing."

For More Proof of Deepfreeze Savings Get this

FREE Booklet

Of course the specific answer to this question is entirely dependent upon the type of products being manufactured in your plant and your manufacturing process, but we can answer it in part by telling you briefly how the Deepfreeze Cold Treating Process is being used in other plants.

Your work might be similar. Take the following few examples for instance:

Manufacturers are using Deepfreeze Cold Treating as a supplement to heat treating to secure greater hardness and more uniformity of structure in machine parts.

Tool manufacturers and tool users are obtaining remarkable increases in tool life by cold treating high speed cutting tools in Deepfreeze Industrial Chilling Equipment. Increases in tool life of as much as 500% have been reported by many tool users.

Manufacturers of precision instruments and gauges are using the Deepfreeze Cold Treating Process to age products and stabilize dimensions. This quick-aging of steel by chilling eliminates costly material growth and warp by holding the finished sizes under all normal temperature changes and handling.

Aircraft manufacturers are using Deepfreeze Cold Treating to test all types of flying instruments and accessories in order to predetermine their reactions to the atmospheric conditions they will encounter in flight.

Manufacturers in general are using Deepfreeze Cold Treating in the assembly of parts. Chilling for shrink-fit assembly not only increases production but eliminates costly rejects because of distortion and scoring prevalent in other methods.

Space limits the number of applications that can be presented here, but you can secure the complete story on Deepfreeze Cold Treating as well as the answer to the question "How to Use Deepfreeze Cold Treating in Your Plant" by dropping us a line. Let us know the type of work at which you are now engaged and we will point out the possibilities and advantages of utilizing cold treating in its production. This information is offered to you without cost or obligation.

The information contained in this booklet will give you a complete account of cold treating with Deepfreeze Industrial Chilling Machines. Whether you are acquainted with the Deepfreeze process of cold treating or not, you will find that the material included will give you the latest facts on the cold treating of metals. Write today for your free copy.

Prompt Delivery

You can do more than talk Deepfreeze... you can get Deepfreeze now. If you are a producer of essential wartime products and can qualify under government priority regulations, we can promptly supply you with a Deepfreeze Industrial Chilling Machine. The sooner you place your order, the quicker your production will benefit.

Deepfreeze

TRADE MARK DEEPFREEZE REGISTERED UNITED STATES PATENT OFFICE

Industrial Chilling Equipment for Shrinking, Testing, Hardening and Stabilizing Metals

2314 DAVIS STREET,
NORTH CHICAGO, ILLINOIS

Division of Motor Products Corporation, Detroit, Michigan

Do You dare cut inventories ?

Here is a safe method . . . that works!

Out of the maze of talk and conflicting statements regarding war contract cancellations and cutbacks—it seems reasonable to conclude that no large-scale production curtailment is expected until after the successful invasion of Europe is an accomplished fact. However, ordnance schedules are constantly being adjusted on account of changing needs and improved designs. This has resulted in recent cutbacks for many metal-working plants. Also, reserve stocks of certain war material have already reached a point where it has been found advisable to cancel further deliveries.

Due to this situation, many manufacturers may overnight be confronted with the task of disposing of steel overstocks. Too often these stocks are not easily converted to other production uses. A valued inventory can quickly become a white elephant.

We urge you to try to avoid this loss. Keep your inventory at a practical working level without excessive reserves. We believe this is entirely safe and practical today—and can be done without incurring undue risk to continuous production. There was a time when warehouse stocks were in rather bad shape and manufacturers, in self-defense, built up high steel inventories. But the WPB has seen the folly of each company carrying big inventories to meet all eventualities, and has permitted a reasonable build-up of general warehouse stocks, which serve everyone. Thus the overall tonnage of idle steel may be reduced, and the cutback and cancellation blows are cushioned.

Stocks of most steel distributors are in good shape to meet all reasonable demands. Reliable trade sources report that these warehouse stocks are now more than 100% over the low of 1942. Ryerson, in particular, has large and complete stocks of bars, shapes, plates, sheets, stainless steel, alloys, tubing and other vital steel products—ready for immediate shipment. Call any one of the eleven conveniently-located Ryerson steel-service plants for your day-to-day or emergency steel requirements.

Prompt, personal service is assured.

JOSEPH T. RYERSON & SON, INC.

★ Steel-Service Plants at Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Pittsburgh, Philadelphia, Jersey City

TEETH
that are shaped
for their job . . .
By comparing various animals you see how accurately their teeth are shaped to meet their individual need. Gear teeth, like natural teeth, work at their best when they, too, are shaped to fully meet the job they have to do.
As the result of extensive research and field testing, Fuller developed gear teeth which are shaped differently from ordinary gear teeth—shaped to do their job better. That's why Fuller Gears give you a transmission which has become notable for its quiet running—its easy shifting—its long wear-life. Be sure the transmission in your new truck is a FULLER.
FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin
Fuller
TRANSMISSIONS

1 SAVES COST OF METAL DIES

Compound curvatures and fairly sharp bends without any inside radius are produced in PANELYTE #906 parts by inexpensive forming dies of Kirksite, cast phenolic, laminated phenolic or hardwood.

2 SIMPLIFIES AND SPEEDS PROCESSING PANELYTE

#906 can be stamped, bent or drawn in process similar to—but much simpler than metal stamping. No need for hot molds. Material is merely heated to temperatures higher than those used in manufacture, molded, and left for very short period in mold for partial cooling.

3 ELIMINATES NEED FOR HEAVY EQUIPMENT OR HIGH PRESSURES

The fast and economical forming of PANELYTE #906 is accomplished with small air cylinders — and, in some cases, hand presses can be efficiently used.

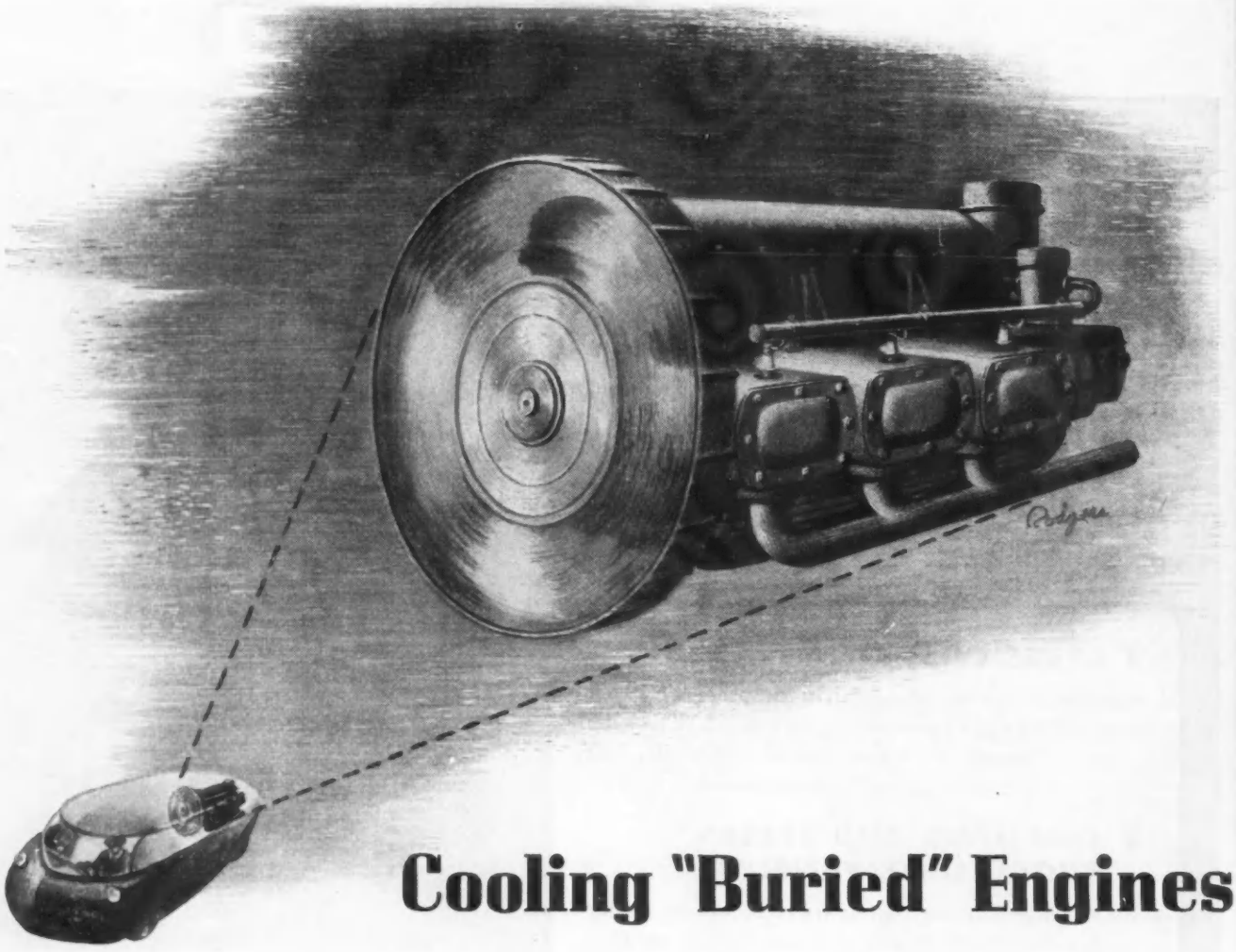
If you manufacture or use laminated phenolic parts of complex design, Grade 906 PANELYTE may save you time — and money. This fully cured thermo-setting sheet plastic opens entirely new fields in plastic fabrication. Write for Engineering Bulletins on Grade 906 . . . and samples.

PANELYTE *the structural plastic*

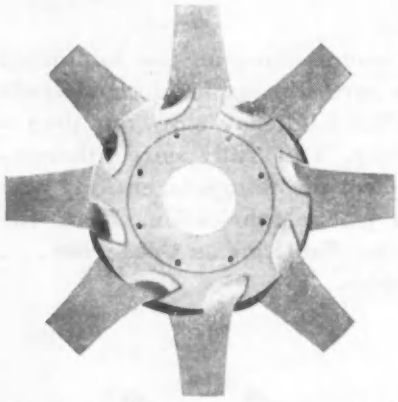
PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS



Cooling "Buried" Engines



DEBOTHEZAT LAMINAR-FLOW steel cooling fan for "buried" engines. Though light in weight, it is stressed to withstand severe torque impulses and other fatigue stresses.

MORE PRACTICAL, more efficient, will be the "buried" rear end engines of postwar motor cars; DeBothezat aerodynamic research will contribute to this with its new engine cooling fan. Advantages of this new fan are that it . . .

. . . efficiently cools a "buried" engine.

. . . uses low horsepower; releases EXTRA *horsepower to the wheels, making practical lighter engine design.*

DeBothezat engine cooling fans are not standardized. There need be no compromise with your engine design for peak performance. A fan is specifically designed for each application.

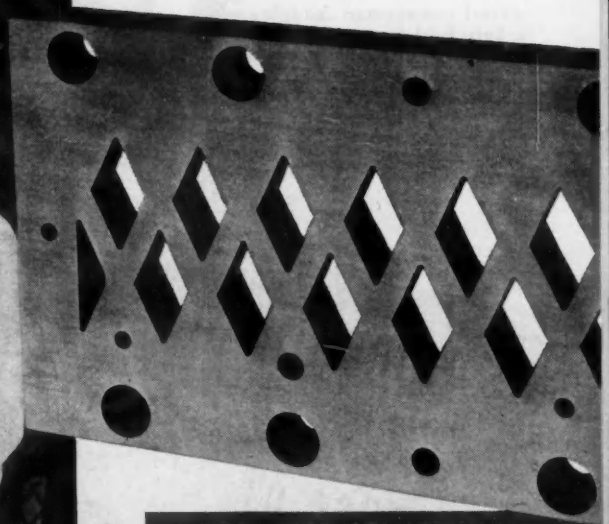
De Bothezat Division of

American Machine and Metals, Inc.

East Moline, Illinois

When writing to advertisers please mention AUTOMOTIVE *and* AVIATION INDUSTRIES

Heater-treater placing an embossing die in a Vapocarb-Hump Hardening Furnace



Warp Ended Means No Grinding

Correct Structure Increases Production

Perfect Surface Saves Hours of Polishing

MUST TOOLS PRODUCE MORE?

Vapocarb-Hump Hardening Helps in 3 Ways

During this year's Battle of Production, hundreds of metal-working plants are finding that the Vapocarb-Hump Method of Hardening helps to bring about big increases in the life of punches, dies, hobs and other war-production tools.

If you have a war-goods tooling problem, we'll gladly arrange for you to talk to people in some of these plants. They'll tell you of three ways in which tool life is prolonged: (1) By lessening or ending warp. (2) By better depth of hardness. (3) By ending all surface blemishes.

But, because all three seldom are found in one tool, we're showing here an example of each. You'll understand why these cases must be taken from pre-war production!

Warp Defeated In Perforation Die

A Maryland company used to make 2 or 3 big diamond-pattern perforating dies at a time, because heat-treating warp twisted them "like pretzels," and grinding them straight weakened them and shortened their lives. Vapocarb-Hump Hardening, by its uniform heating, ended warp and doubled the lives of these tools.

One Die Does Work of 30

Belt buckle dies were producing an average of 1200 pieces, because the heat-treater could only guess when to quench them, in hardening, and their structure was accordingly weak. Vapocarb-Hump Hardening, by locating *and recording* the critical point, helped increase the production, successively, to 2300 pieces, then 8500, then 18,000 and finally 38,000 — an average of 30 times the pre-Vapocarb figure.

Perfect Surface For Stamping Die

Life of engraved dies, like the one shown, was often shortened because the method of hardening which was employed permitted surface pits or scale to form. These had to be "polished" out, thus weakening the hardened skin. Vapocarb-Hump hardening eliminated this because its protective atmosphere ends all scaling and pitting in furnace; average life of dies has been sharply increased.

Further particulars of Vapocarb-Hump Hardening are given in Catalog T-621, or an engineer will call on request to discuss a specific problem.

Jrl. Ad T-621(27)

ARMY · NAVY

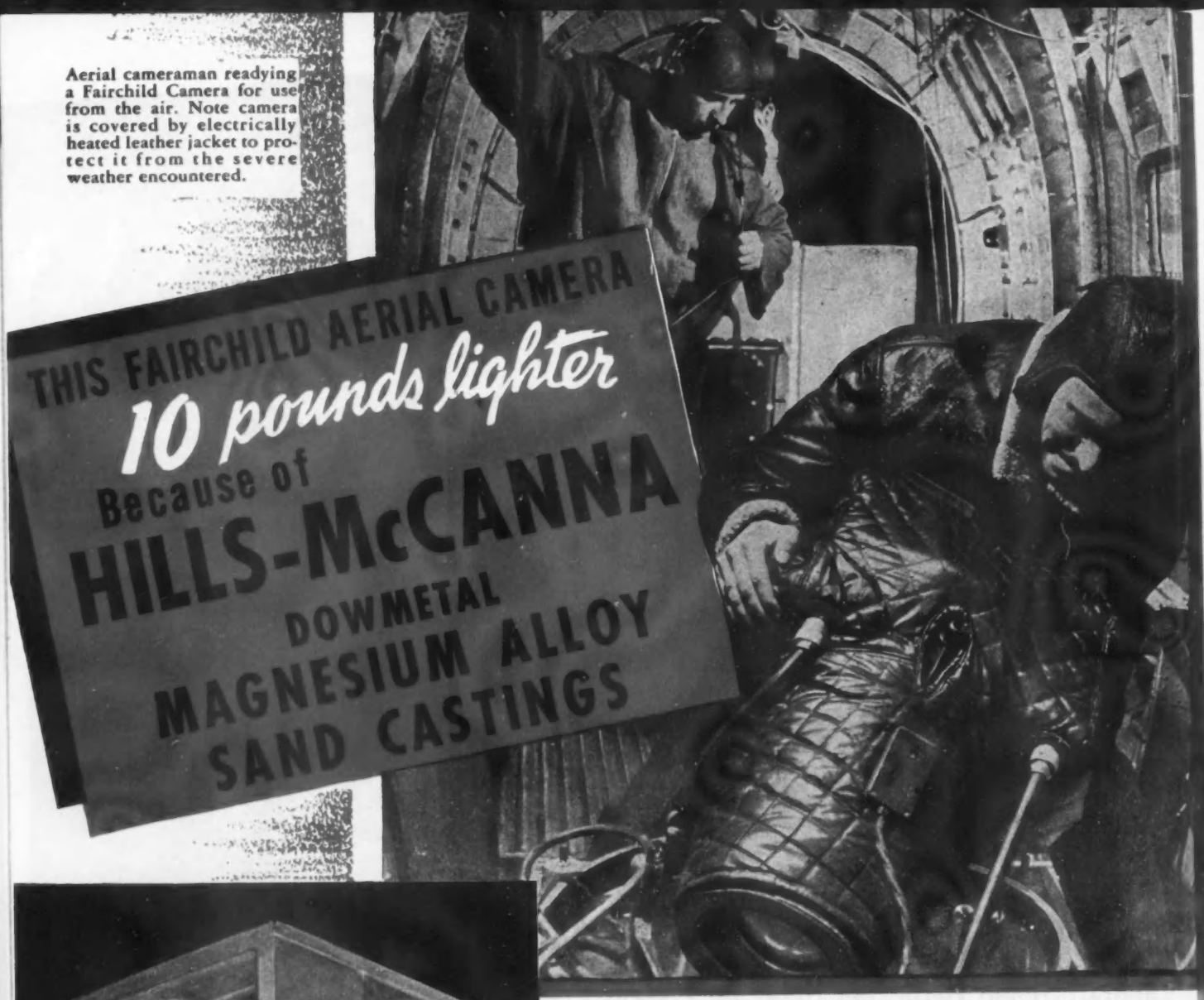
depends on me!

A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA

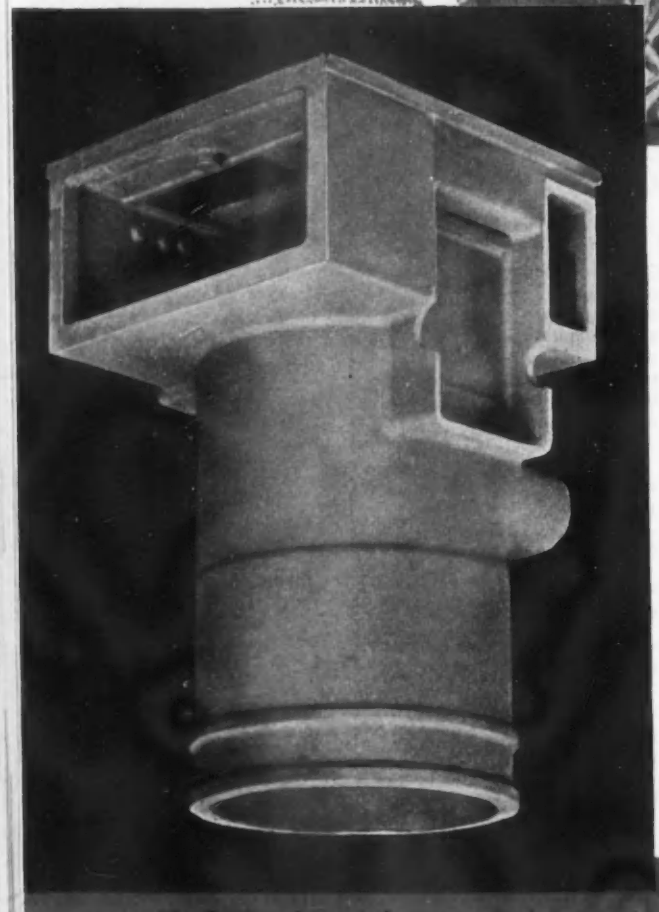
LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACE



Aerial cameraman readying a Fairchild Camera for use from the air. Note camera is covered by electrically heated leather jacket to protect it from the severe weather encountered.

THIS FAIRCHILD AERIAL CAMERA *10 pounds lighter* Because of HILLS-McCANNA DOWMETAL MAGNESIUM ALLOY SAND CASTINGS



The Casting shown is for an automatic reconnaissance aerial camera. It weighs only 12.5 pounds before machining.

RECONNAISSANCE planes, whose job it is to help secure aerial photographs of enemy movements and territory, are given *extra* altitude by any weight-savings in equipment carried.

The designers of Fairchild Aerial Cameras contribute toward this weight saving by utilizing Hills-McCanna Magnesium Alloy Sand Casting in the removable roll film magazine and the central portion of the camera lens cone.

The remarkable lightness of magnesium metal combined with exceptional strength and durability may offer just the thing you need in your post-war products. Let us discuss your projected peace time plans and products.

FOUNDERS OF NON FERROUS ALLOYS SINCE 1870

HILLS-McCANNA CO.
3015 N. WESTERN AVE. · CHICAGO

PROPORTIONING PUMPS · AIR & WATER VALVES · CHEMICAL VALVES
MARINE VALVES · FORCE-FEED LUBRICATORS · NONFERROUS CASTINGS

LIQUID PACKAGING

for Aircraft Parts!

WHIZ RUST PREVENTIVE COMPOUNDS
(Thin Film, Polar Type)

WHIZ AIRCRAFT PRESERVATIVE COMPOUND
(Paralketone Type)

WHIZ RUST PREVENTIVE COMPOUND
(Paralketone Type)

WHIZ CORROSION PREVENTIVE COMPOUND
(For Aircraft Engines and Parts)

AND OTHER SPECIAL COMPOUNDS

A complete line of rust and corrosion preventive compounds is manufactured by R. M. Hollingshead Corporation, a major supplier for Army and Navy aircraft. There are WHIZ compounds—conforming fully to Government specifications—for the protection of internal and external surfaces.

Applied to plane parts and weapons by spraying, swabbing, or dipping—depending on type—this "liquid packaging" eliminates the risk of rust and corrosion from factory to battle-line . . . is easily, quickly removed—*if* removal is required.

Your inquiries about these protective compounds will receive prompt attention. Our engineers are ready to work with your engineers in designing special chemical products to meet your particular needs. *R. M. Hollingshead Corporation, Camden, N. J.; Toronto, Canada.*

Also makers of Whiz Hydraulic Fluids, Compounded Lubricants, Lubricating Oils, and Cleaning Compounds for aircraft.

Whiz

Hollingshead

LEADER IN MAINTENANCE PRODUCTS

BUY MORE WAR BONDS AND STAMPS NOW!

Sound the Alert!

MANAGEMENT
LABOR

—for the 5th War Loan drive during June and July. The need for the 5th War Loan is immediate, crucial. For impending events may make the 5th the supreme financial effort of the war.

The U. S. Treasury has set the overall goal at $16,000,000,000 — $6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—*and it must be raised.*

That's why the U. S. Treasury asks Management and Labor to sit down together and organize—NOW!

For organization—good organization—has been responsible for the excellent showing of the payroll market. And its most important single superiority has been personal solicitation—desk to desk, bench to bench, machine to machine personal solicitation. 71% of all persons on payroll deductions were solicited for the 4th War Loan.

Now, to personal solicitation, add the sales incentive of a definitely established plant quota. Build your campaign around a quota plan. Set up departmental goals. Stress percentage of participation figures. Stimulate group enthusiasm.

In planning your quota campaign, work in close cooperation with the Chairman of your War Finance Committee. Everything is set to make the 5th War Loan drive a huge success—with your help!

(Note: You've read this message. If it doesn't apply to you please see that it reaches the *one* person who can put it in action!)

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an *average* $100 *cash* (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. 90% of the employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: **JOHN DOE Mfg. Co.** — 1,000 Employees

1,000 employees x $100 Regular Payroll deductions during the eight weekly payroll Accounting Periods of June and July = $100,000 Cash Quota

30,000 / $70,000 (to be raised by sales of extra Bonds to at least 900 employees)

ORGANIZE • SOLICIT • DELIVER

The Treasury Department acknowledges with appreciation the publication of this message

★ *This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.* ★ ★

High Precision Molding?

Powdered Metals, Abrasives or Plastics? If so, prevent off-gauges with this Birdsboro stress-compensating Hydraulic Press. New frame and cylinder construction minimizes deflections so parts may be pressed accurately to thickness. Self-contained with quick pressure adjustment, preset by handwheel. Can be arranged either for cold pressing or for hot work with steam platen — either single or multiple openings, single or two sided feed. Available in sizes from 250 to 3,000 tons. Larger sizes can be readily developed. Write Birdsboro today.

For additional information send for the Birdsboro Hydraulic Plastic Press Catalog.

BUY WAR BONDS

BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY
BIRDSBORO, PENNSYLVANIA

BIRDSBORO
HYDRAULIC PLASTIC PRESSES

Readers' Choice!

AUTOMOTIVE and Aviation INDUSTRIES has no subscription salesmen —yet it has 38,000 readers.

Its subscription renewal percentage is by far the highest in its field, and one of the highest, if not the highest among business magazines.

Its subscribers renew, for the most part, upon presentation of a renewal bill by mail—or a reminder, likewise by mail.

Also, a little more than 4 automotive or aviation men read every paid-for plant copy.

Any publication selected by its readers—not sold to them—automatically has the highest degree of reader interest, as has AUTOMOTIVE and Aviation INDUSTRIES in these two industrial fields.

AUTOMOTIVE *and Aviation* INDUSTRIES

A CHILTON Publication • Chestnut and 56th Streets, Philadelphia, 39, Pa.

Planting A Victory Garden . . . *by Candle-Light*

A STRANGE and fearful candle-light brightens the streets of this Axis town tonight. A moment ago, it lay safely hidden under cover of a moonless blackout.

But, it was on tonight's schedule of time-table bombing and as "Libs" and "Forts" come in for the "kill", this night-time enemy target is brought into sharp relief by the brilliance of McAleer military pyrotechnics.

In that revealing glare the refinery's oil tanks stand out like giant mushrooms in a meadow—but not for long. Caught in the cross-hairs of a bombsight, they disappear in thick black smoke. A power station crumbles under a well planted "stick". Factories and warehouses belch flame that reaches fiery fingers into the heavens.

It's Victory Garden planting of a different sort. Seeds of retribution from which will come fruits of Victory!

Making military pyrotechnics is but one of the important war production tasks assigned to McAleer. There are other For-Victory products extending into the fields of military aeronautics and hydraulics as well.

ON THE HOME FRONT we fight the war too . . . furnishing *quality-controlled* finishing materials and methods which contribute more to the war effort. If increased finishing efficiency on metal, plastic or wood can help YOUR war effort . . . our advisory facilities are at your service.

McAleer
MANUFACTURING CO.

Manufacturers of Quality-Controlled Finishing Materials, Military Aircraft Sub-assemblies and Pyrotechnics . . .

ROCHESTER, MICHIGAN

Cannon Quality Control is an extra you get when you buy Cannon Connectors. It's there. You can see it in better finish, better fit, die castings, wherever possible, special alloys for strength and lightness, fine machining.

You recognize it in easier assembly. You realize it in longer satisfactory service.

What is it worth? What does it cost to trace a broken circuit only to find the cause in a faulty plug? What is it worth to know that motors, instruments and lights won't fail because a plug goes wrong?

What's the price of a plane and the value of the lives of its passengers and crew?

NEW SOLENOID BULLETIN

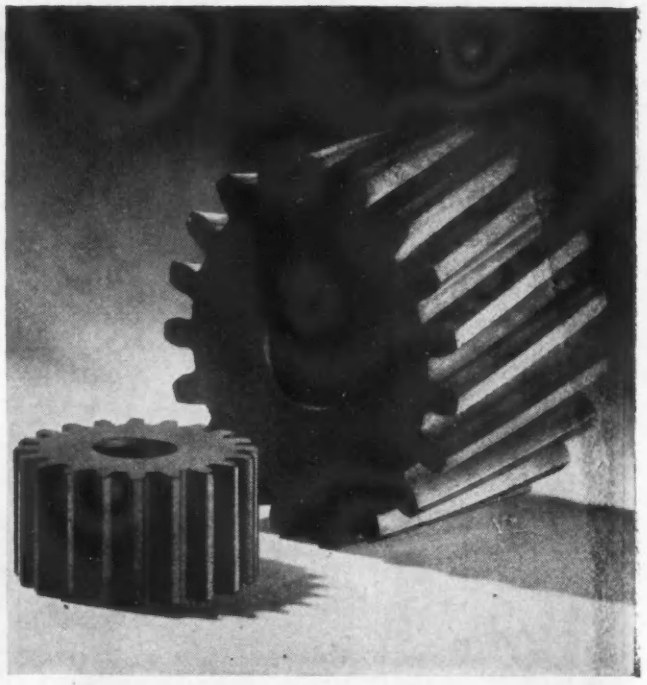
New 24 page Solenoid Bulletin contains Cannon's complete line of Direct Current Solenoids of 14 and 28 volts with a wide range in amperage and pounds push and pull. Fully illustrated with drawings, photos and ample data on response characteristics. Request your free copy from Dept. A-109, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, California.

CANNON ELECTRIC

Cannon Electric Development Co.
Los Angeles 31, California

Canadian Factory and Engineering Office:
Cannon Electric Company, Ltd., Toronto, Canada

Representatives in principal cities. Consult your local telephone book



Sh-h-h-h-h-h-h!

TAYLOR SILENT GEARS AT WORK

Taylor Phenol Fabric Gears, meshed with metal gears in the gear train, eliminate noisy, metal-to-metal contact, absorb the shock of tooth impact, lessen gear wear, and, by minimizing vibration, reduce wear throughout the entire machine.

This material is not only strong enough for the heaviest-duty drive, but is so light in weight that it materially reduces the dead load on the drive. These gears are impervious to water, oil, and most chemicals; are not subject to rodent attack; are unaffected by oxidation; and resist the effects of abrasive dust.

Blanks may be machined in the same manner as metal but, of course, much more rapidly and economically. They can be cut to any type of gear. Commercial gear cutters in principal cities maintain a stock of Taylor Silent Gear blanks in various sizes—or write us direct about your requirements.

TAYLOR FIBRE COMPANY

LAMINATED PLASTICS: PHENOL FIBRE • VULCANIZED FIBRE

Sheets, Rods, Tubes, and Fabricated Parts

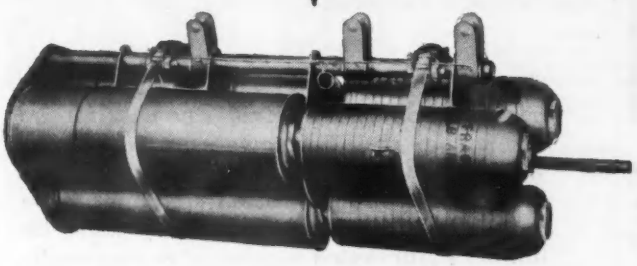
NORRISTOWN, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES

PACIFIC COAST HEADQUARTERS: 544 S. San Pedro Street, Los Angeles

"PACKAGED" wartime skills for YOUR peacetime product

"PACKAGED METAL ENGINEERING*"

- ✓ CUTS PRODUCTION AND ASSEMBLY COSTS ON PARTS AND PRODUCTS
- ✓ SAVES MATERIALS AND WEIGHT
- ✓ IMPROVES UTILITY AND APPEARANCE



The Bomb Cluster assembly is an ingenious war-time application of "Packaged Metal Engineering." Grammes inventive production skills, precision fabrication abilities, and clever assembly methods are successfully utilized in the manufacture of its more than 30 units.

With 69 years of precision fabricating skills, cleverly devised assembly methods, and broad "know-how," Grammes can save you time, money and materials on your parts or product. The facilities listed provide a *centralized* set-up for efficient and economical precision fabricating and assembling.

STAMPING	ETCHING	LINE ASSEMBLY	DRILLING
DRAWING	TOOLS & DIES	MACHINING	WELDING
SPINNING	EMBOSSING	SPRAYING	PLATING
WIRE FORMING	LITHOGRAPHING	HARD ENAMELING	
	SCREW MACHINES	HEAT TREATING	

Grammes can be your *complete* manufacturing source, providing the all-inclusive services and facilities of "Packaged Metal Engineering"—**in one package . . . one service . . . we take over ALL responsibility, acting as YOUR factory, from Design Research to Drop Shipments.*

From idea development and product improvement to post-war manufacture, Grammes Contract Service facilities are available NOW for Research, Design, and Engineering. Let us work with you, complete confidence assured. Send today for our booklet—"Contract Service by Grammes"—address Dept. 11-6.

"MASTER CRAFTSMEN IN METAL"

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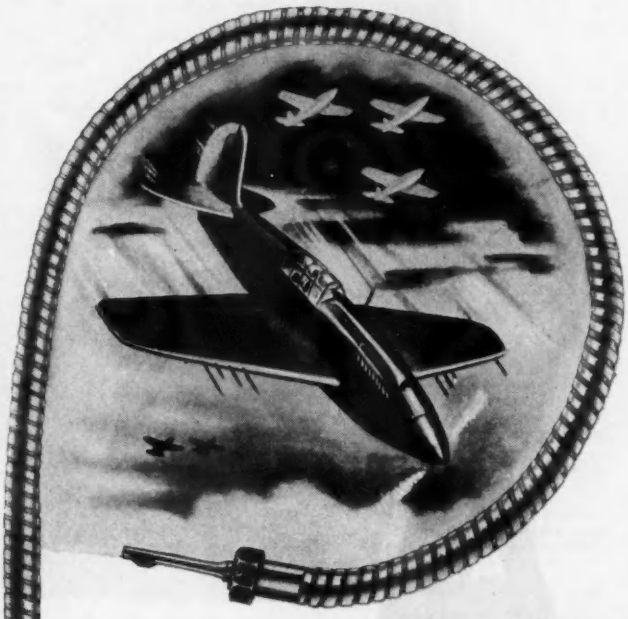
L. F. GRAMMES & SONS, INC., ALLENTOWN, PA.

ESTABLISHED 1875

NEW YORK CHICAGO DETROIT CLEVELAND MILWAUKEE PHILADELPHIA

Oldsmobile CHEVROLET Mack

ALSO CREATORS OF DECORATED NAME PLATES • TRIMS • BEZELS • ESCUTCHEONS



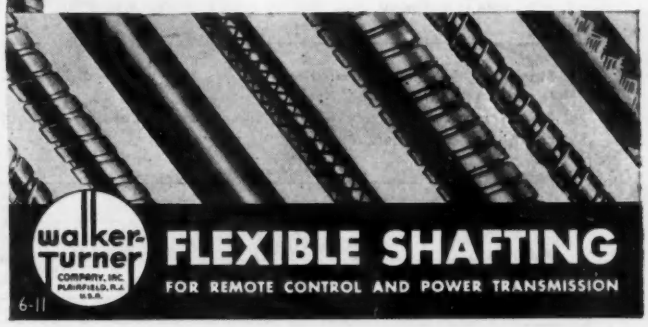
WHEN THE "LONGEST WAY 'ROUND IS THE SHORTEST WAY HOME"...

Specify Walker-Turner Flexible Shafting

In transmitting light power loads between two points, it is often possible to design a simpler, lighter, more compact product with Flexible Shafting than with gears.

You'll find, too, that it pays to specify Walker-Turner Flexible Shafting on jobs like these — for smoother power flow, more sensitive control, trouble-free operation. Into this product, we've packed all the "know-how" picked up in years of manufacturing our own flexible shaft machines . . . in years of working with other manufacturers on problems of power transmission and remote control. Let us know if we can put that experience to work for you!

WALKER - TURNER COMPANY, INC.
Plainfield • New Jersey



ACCOMPLISHMENT *is what counts*

CLAIMS of unusual ability in the injection molding of thermoplastics are meaningless . . . unless backed by evidence of ACTUAL ACCOMPLISHMENT. In this respect, Standard Molding Corporation has one of the industry's really unique records.

Above are shown but 41 of the hundreds of plastic parts that Standard has successfully produced by the injection molding process. Many of these are delicate instrument parts for fighter aircraft . . . parts which must be turned out on a mass production basis, and yet conform to the micrometric tolerance demands of the Air Forces.

The manufacturing and engineering skills that made these plastic achievements possible are now available to you in the development of your present and postwar products. For expert and detailed analysis by the Standard Engineering Staff, mail us your blue-prints today.

STANDARD MOLDING CORPORATION

Dayton 1, Ohio

WRITE FOR THIS CATALOG
—on your business letterhead, or tear out this coupon and attach it to your stationery today.

Standard Molding Corporation
Dayton 1, Ohio
Please send me a copy of your new Plastics Catalog without charge or obligation.

Name_____

Firm Name_____

Address_____

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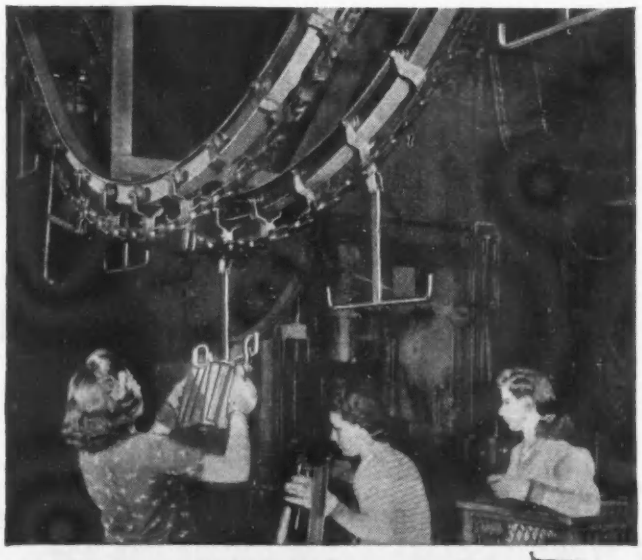
The fact that the production of war materials has reached its peak provides no basis for the assumption that manpower problems soon will cease to exist. The demand by the Armed Forces for men and women continues to be great. In industry, the tendency must be toward an increased number of women workers and older men. In this period, more than ever before, it becomes necessary to mechanize the handling of materials through processing, storage, shipping, and, in fact, wherever possible — to minimize lifting, pushing, and excessively fatiguing effort. Here, Mathews Engineering can help as it has done in thousands of great American and Canadian war plants during this emergency. Your Mathews Engineer can show you how modern Mathews methods can conserve manpower and promote economy in the materials-handling phase of your manufacturing.



Mathews Conveyer Company
ELLWOOD CITY, PENNSYLVANIA

FUEL Economy AND FURNACE Efficiency

A battery of Fisher Electric Tilting Nose Pour Furnaces in a modern foundry in California. As a wartime emergency measure these furnaces were designed to be fired with either gas or oil with quick change-over. Capacities shown are 1200 pounds of brass, or 400 pounds of aluminum.

Correct furnace atmosphere is all important for best melting conditions with fuel economy at its highest and melting speed at its best for all purpose economy. Wartime light metal melting experience has established that the best conditions for pot life and efficiency of heating are reached when a "neutral" furnace atmosphere can be maintained with maximum CO_2 and only a trace of CO and free oxygen present. A prime requisite in obtaining this ideal condition is the use of multiple burners with a proportional mixer or equal for maintaining the proper gas and air mixture, and an air-oil ratio controlling device if oil is used.

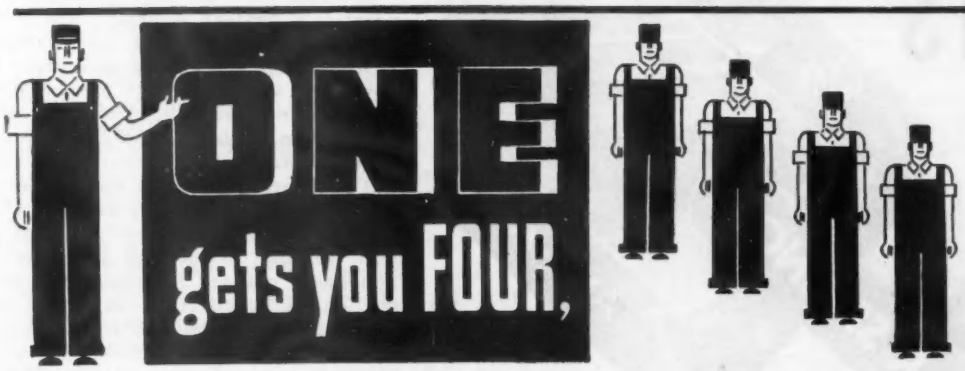
These and other principles, although not commonly taken into full consideration, are a basic part of the design of Fisher Furnaces and are features which will be sought, after the day returns when low operating costs will be of first importance again. Fisher's Non-Ferrous Metal Melting experience also offers you (1) the benefit of many years of experience in foundry equipment coordination and (2) a wide selection of melting furnaces including electric and hydraulic tilting, hand tilting and stationary types incorporating the latest mechanical features, with a capacity for every purpose.
Present your Non-Ferrous Melting and Layout problems to Fisher. Write for complete information.

5525 North Wolcott Avenue, Chicago 40, Ill.

Fisher FURNACE COMPANY

Engineers and Manufacturers

ONE gets you FOUR,



RELEASES THREE..

One man—or one woman, for that matter—can do the work of four men in materials moving with the revolutionary HYDROLECTRIC motorized lift truck. Users, faced with man-power losses to the military, are able to "make up" the loss on this one-to-four ratio, thus releasing three men for other effective duties.

The HYDROLECTRIC is the original creation of the Stuebings, originators of Lift Trucks in 1910. It costs only one-third as much, weighs only one-third as much as other "rider" type trucks of equal capacity. User recommendations based on 15 years of 8-hour-day performance. Write for immediate information.

LIFT TRUCKS, INC.

2425 SPRING GROVE AVENUE, CINCINNATI 14, OHIO

Dealers' Franchises in Big Demand

(*Continued from page* 46)

and 1932. It is unlikely that the manufacturers will repeat their mistakes of that period in excessive granting of franchises in the interests of greater volume sales, although there was some tendency in that direction in 1940-41 in certain localities.

Most companies have not replaced lapsed franchises during the war period unless the lack of a dealer in a particular locality handicapped the service needs of the owners of that make of car in that area. The companies feel they have a responsibility to the owner body as well as the dealer body. In some cases the manufacturer has signed a service contract with a repair shop on a temporary basis and in others the company has arranged with a competing dealer to furnish service on a wartime emergency basis.

General Motors, whose dealers accounted for 47.3 per cent of the new passenger car registrations in 1941, announced a bonus plan three months after Pearl Harbor to reward those dealers who maintained their franchises during the war period and provided service for owners of GM cars. For a period of two years after production is resumed, GM dealers who have served in accordance with their prewar status without interruption through the period of suspended production will be entitled to a bonus percentage up to a maximum of 40 per cent of their basic allotment, which is related to the percentage of purchases made of the corporation's 1941 production, subject to the availability of cars. However, 93 per cent of the GM dealers on a volume basis were still in business up to the end of 1943. This will materially affect the number of cars that will still be available for bonus purposes due to the small number of dealer terminations. If passenger car production is resumed on the basis of 2,000,000 units the first year, GM's proportional share, predicated on 1941 production, would be 996,000 vehicles. With only a 7 per cent dealer mortality by volume, this would leave 66,220 cars available for bonus purposes, which would not go far among GM's more than 15,000 dealers.

Because no new passenger cars have been manufactured since February, 1942, a tremendous sales potential is being built up for postwar automobile sales. This is variously estimated at from eight to fifteen million vehicles. Therefore, the dealers who hold franchises guaranteeing them a share of postwar production to sell consider those franchises a golden investment which they are going to protect for their own advantage.

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Forged securely together by identical standards of quality and production, both B-G-R Spring Plants act as one to give you unlimited service in springs of all kinds—in any quantity. When you buy springs—get the benefits of B-G-R research and engineering design — for long life and trouble-free performance.
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TWO PLANTS FOR SPRING SERVICE
DETROIT and ANN ARBOR
MICHIGAN

Cold-Drawn Tubing Heads List of Hard-to-Get Steel Products

(*Continued from page* 48)

among the steel producers has announced the start of an ambitious iron mining program in Venezuela, where concessions have been obtained, expected to yield up to two million tons of iron ore annually.

Regulations governing the consumption of cadmium have been liberalized by WPB and users are now permitted to maintain a 30-day inventory of cadmium-containing items, the list of which has also been extended.

While officials of WPB's Copper Division report finding little in the copper picture to justify a brighter view of the supply situation, members of the Copper & Brass Research Association, an industry body embracing virtually all of the important fabricators and producers, at its annual meeting had presented to it a number of optimistic reports, based chiefly on expectations of improved post-war technique as the result of intensified research.

Anouncement by the Chrysler Corporation's Amplex division that it is meeting with success in the production of self-lubricating bearings of powdered aluminum has caused considerable interest. The Aluminum and Magnesium Division of WPB has announced that primary magnesium output averaged over 41,000,000 pounds a month during the first quarter of this year and exceeded all previous production records. In view of the recently announced cutback in magnesium production, first quarter output is expected to remain the peak for the duration of the war. According to the Netherlands and Netherlands Indies News Agency, Venezuela has begun the exportation of nickel, 282 tons having been shipped recently to New York.

United States Rubber Co. Will Build New Laboratory

Plans for the construction of a new control and development laboratory, incorporating the latest scientific methods of testing and analyzing materials, were announced by the United States Rubber Company.

The new laboratory will cost approximately $20,000 and will be located in a central position in the present Los Angeles factory building. Analytical and testing units formerly scattered throughout the plant will be integrated into one enlarged department. Additions of new equipment will nearly double facilities.

It's a SNAP

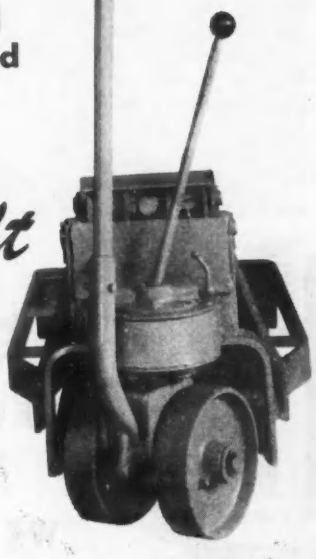
To Lift 3 Tons and Move 'Em Around

with

SERVICE

Lever Lift

HYDRAULIC LIFTRUCK



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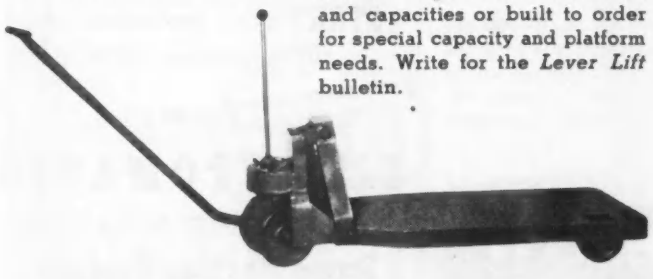
- 30 lbs. Effort Handles Heaviest Loads
- All Welded Construction

To do its best, a lift truck should lift a load easily, lift swiftly, and stand up under the pounding of heavy-duty, day-in day-out service. Service's *Lever Lift Hydraulic Lift Truck* meets those specifications—and goes way beyond them. For example, only 30 pounds effort lifts the heaviest loads. It's built for easy maneuvering in tight corners. More of the features you want are listed at the left. Check them, remembering the *Lever Lift* is available in a wide range of standard sizes and capacities or built to order for special capacity and platform needs. Write for the *Lever Lift* bulletin.



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Eastern Factory: 420-26 Somerville Ave., Somerville (Boston) Mass.
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For these fighting planes over Europe and other theatres of war, Lawson workers have contributed many types of precision aircraft engine parts. Lawson employees, star workers in the battle for victory, are again being honored for their long record of war production.

This new fighting star which adorns our "E" pennant marks the third citation received for meritorious war service in a highly specialized field. Lawson workers dedicate themselves anew to the task of producing star war materiel to bring the day of victory closer.

FIRST "E" AWARD	SECOND "E" AWARD	THIRD "E" AWARD
April 29, 1943	October 30, 1943	May 17, 1944

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"Your Partners in Precision"

New Products

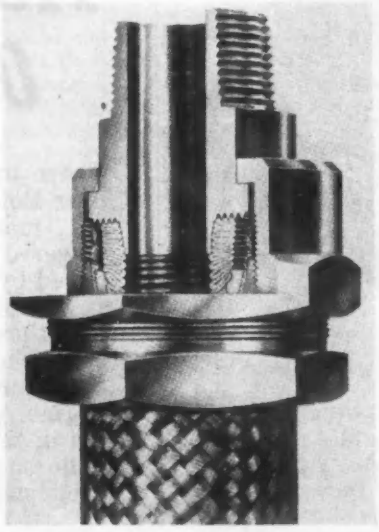
(*Continued from page* 80)

The sealer is provided in tape form in thicknesses of from .015 in. up to .125 in., in bulk form, and in slugs of a size to fit the barrel of special high pressure air guns for use in resealing integral fuel tanks in existing aircraft by the pressure injection method.

Detachable Coupling for Flexible Metal Hose

A detachable brass coupling for helical flexible metal hose in sizes from ¾ in. to 1½ in. ID has been developed by Packless Metal Products Corp., New Rochelle, N. Y., offering the advantage of being mechanically self-sealing. No brazing is employed.

The unit consists of four parts—the nut, back, stem and split ring. When assembled the convolutions of hose and the metal braid are held by pressure between the members. The coupling is said to withstand pressure tests of up to 800 psi.



Coupling for flexible metal hose

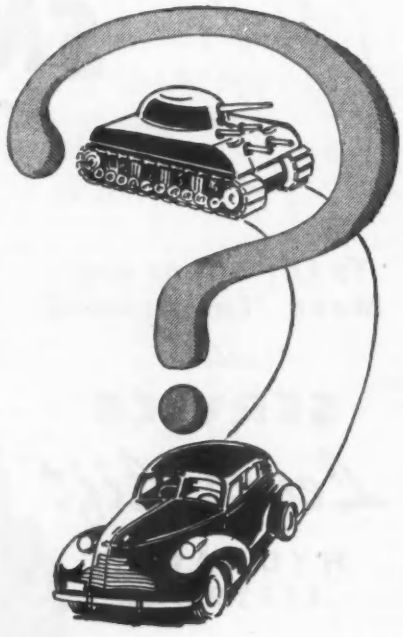
A further feature of design is the self-contained union which permits the pipe thread end of the coupling to be screwed directly into the machine fitting and the union tightened without twisting the hose.

BOOKS . . .

TORQUE CONVERTERS (or Transmissions) (Second Edition), published by **P. M. Heldt, Nyack, N. Y.** Supplementing the comprehensive treatment of the subject in the first edition, this new edition also contains articles on transmission efficiency and a method of determining it, on electric couplings, a method of laying out geared transmissions with helical gears, and methods of gear finishing.

WHAT SPEED

RECONVERSION



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WE CAN -

The same automatics that are now making parts for almost every type of war machine can also turn out an endless variety of peacetime parts for you a few hours after VICTORY.

FULL SPEED reconversion is good for your men and good for the nation.

START your peacetime lines rolling sooner with parts

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GAUGES THIN AS .001
COILS UP TO 300 LBS. PER IN. OF WIDTH
WIDTHS UP TO 24 IN.
LIGHT YET STRONG
STANDARD AND SPECIAL TEMPERS
CLOSEST TOLERANCES PROVIDE MAXIMUM FEET PER LB.
CONTROLLED UNIFORMITY ASSURES DUPLICATION OF ALL DESIRED PHYSICALS IN COIL AFTER COIL

. . . SO MANY FABRICATION ECONOMIES

When all of the advantages of CMP precision THINSTEEL are considered it is no wonder so many metal fabricators specify it exclusively.

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Subsidiary of the Cold Metal Process Co., Youngstown O.

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PRECISION COLD ROLLED

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WHITNEY-JENSEN PRODUCTS
30 YEARS EXPERIENCE

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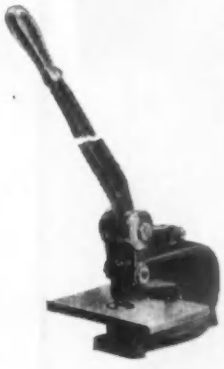
Standard, Alligator, Crab, Snake Head, and Pelican types for speedy, accurate, uniform setting of aluminum rivets up to 5/32" size. Pelican type (shown) in 6 sizes from 1¾" to 6" throat-depth, other types in a total of 25 different sizes. REDI-SET model has interchangeable dies for several styles of rivets.



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Improved model has welded steel frame, lighter weight, new depth and side gauges, and greater throat depth. Capacity ¼" hole in ¼" iron. Roller bearing lever type for easy operation. Operator works in front.

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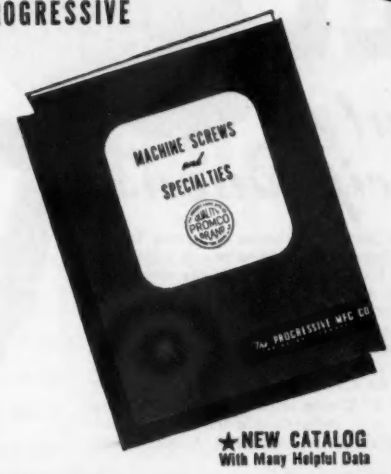

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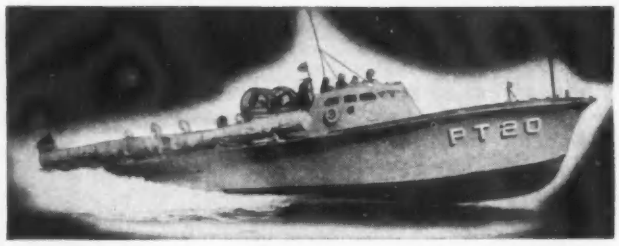

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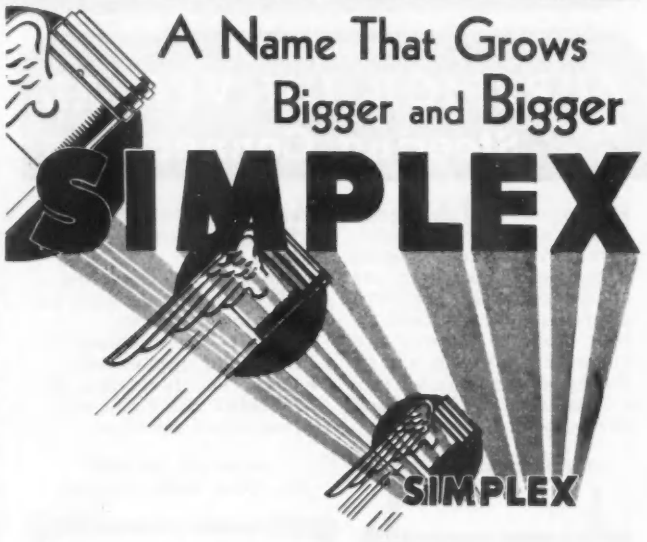

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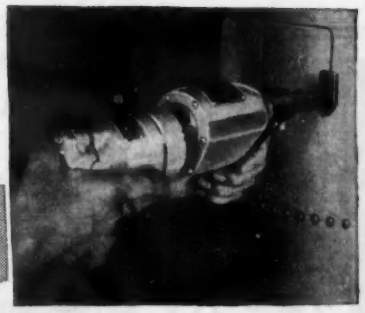

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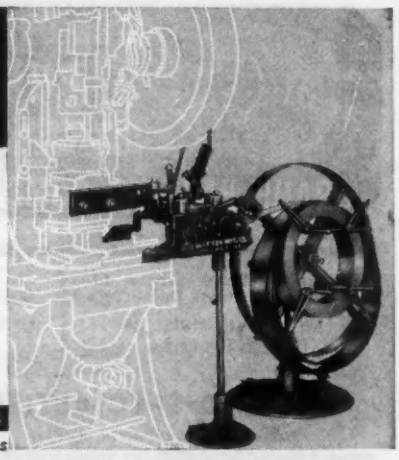

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Abrasive Company 164
Abrasive Dressing Tool Co. —
Abrasive Machine Tool Co. —
Acadia Div. Western Felt Works 126
Accurate Spring Mfg. Co. 84
Ace Mfg. Corp. —
Acheson Colloids Corp. 103
Acme Pattern & Tool Co., Inc. —
Adel Precision Products Corp. 93
Aero Screw Company 75
Aero Supply Mfg. Co., Inc. 211
Aeroproducts Div. G.M. Corp. 121
Aeroquip Corporation —
Aetna Ball Bearing Mfg. Co. —
Ahlberg Bearing Co. 3
Air-Maze Corp. —
Air Reduction Sales Co. —
Aircraft Accessories Corp. —
Aircraft & Diesel Equip. Corp. 202
Aircraft-Marine Products, Inc. 154
Aircraft Nut Corp. —
Aircraft Screw Products, Inc. —
Aircraft Standard Parts Co. 74
Ajax Electrothermic Corp. —
Ajax Manufacturing Co., The 132
Allegheny Ludlum Steel Corp. —
Allied Products Corp. —
Allison Div., General Motors —
Aluminum Co. of America 97
Aluminum Industries, Inc. —
Alvey-Ferguson Co., The 56
American Air Filter Co., Inc. 72
American Bosch Corp. —
American Brake Shoe Co. —
American Brakeblok Div. —
American Broach & Machine Co. —
American Chain & Cable Co., Inc. 70
American Chemical Paint Co. 149
American Coil Spring Co. —
American Felt Co. 210
American Hammered Piston Ring Div. Koppers Co. 55
American Metal Works, Inc. 210
American Screw Co. —
American Steel & Wire Co. 166
Andover Motors Corp. —
Arens Controls, Inc. —
Arkansas Fuel Oil Company —
Armstrong Cork Co. 101
Aro Equipment Corp. —
Arrow Safety Device Co. 106
Arter Grinding Machine Co. —
Asian Air Associates, The 211
Associated Spring Corp. 200
Atlas Drop Forge Co. 209
Auto Specialties Mfg. Co. —
Automatic Transportation Co. —
Automotive and Aviation Industries 194

B-H Aircraft Co., Inc. 210
Bakelite Corp. (Plastic Div.) —
Baker Brothers, Inc. 170
Baker Ind. Truck Div. Baker-Raulang Co. —
Baldwin Southwark Div. 128
Bantam Bearings Div., The Torrington Co. —
Barber-Colman Co. 214
Bardwell & McAlister, Inc. 62
Barnes Co., W. F., & John —
Barnes-Gibson-Raymond Div. Associated Spring Co. 200
Bearings Co. of Amer. —
Bendix Aviation Corporation
Bendix Products Div. 148
Eclipse Machine Div. 78
Bendix-Westinghouse Automotive Air Brake Co. 139
Berg Engineering Service 210
Bethlehem Steel Co. 173
Bijur Lubricating Corp. —
Birdsboro Steel F'dry & Mach. Co. 193
Black & Decker Electric Co. 88
Blakeslee & Co., G. S. 208
Blanchard Machine Co., The —
Bliss & Laughlin, Inc. —
Boots Aircraft Nut Corp. 86
Borg & Beck Div. Borg-Warner 80
Borg-Warner Corp. 109
Bower Roller Bearing Co. —
Bridgeport Fabrics, Inc. —
Bridgeport Thermostat Co. 113
Brillion Iron Works, Inc. —
Bristol Co., The —
Brush Development Co., The —
Bryant Chucking Grinder Co. —
Buell Manufacturing Co. 100
Bullard Co., The —
Bulldog Electric Products Co. —
Bundy Tubing Co. 5
Bunting Brass & Bronze Co. —
Burdett Manufacturing Co. —
Burgess-Norton Mfg. Co. —

Camloc Fastner Corp. —
Campbell, Andrew C., Div., Amer. Chain & Cable Co., Inc. 70
Campbell, Wyant & Cannon Foundry Co. —
Cannon Electric Development Co. 196
Carbide & Carbon Chemicals Corp. —
Carboloy Co., Inc. 124
Cardox Corp. 11
Carnegie-Illinois Steel Corp. 118-119
Carpenter Steel Co., The 47
Celanese Celluloid Corp. —
Central Equipment Co. 110
Central Screw Co. —
Chace Co., W. M. —
Chambersburg Engineering Co. 112
Chandler Products Corp. —
Cherry Rivet Company —
Chicago Rawhide Mfg. Co. 81
Chicago Screw Co., The 102
Chrysler Corporation —
Cincinnati Milling Machine Co. —
Cities Service Oil Co. —
Clark Equipment Co. —
Clark Tractor Div. —
Clayton Mfg. Co. —
Clearing Machine Corp. 111
Cleveland Pneumatic Tool Co. —
Clifford Mfg. Co. —
Climax Molybdenum Co. 43
Cold Metal Products Co., The 203
Columbia Steel Co. 118-119
Cone Automatic Machine Co., Inc. —
Consolidated Vultee Aircraft Corp. 114-115
Continental-Diamond Fibre Co. —
Continental Motors Corporation 183
Continental Rubber Wks. —
Continental Screw Co. —
Corbin Screw Corp., The —
Cotta Transmission Corp. —
Crane Packing Co. 210
Cullen-Friedstedt Co. —
Cunningham Co., M. E. —
Curtis Pneumatic Mach. Div. —

Danly Machine Specialties, Inc. 210
Dardelet Threadlock Corp. —
Davis & Thompson Co. —
Dazor Manufacturing Co. 130
Dearborn Gage Co. —
De Bothezat Div. of American Machine & Metals, Inc. 188
Deepfreeze Div. Motor Products Corp. 184
Denison Engineering Co., The —
Detrex Corporation 90
Detroit Broach Co. 147
De Walt Products Corp. —
Diamond Tool Co. 209
Dings Magnetic Separator Co. —
Disston & Sons, Inc., Henry 144
Dole Valve Co., The 160
Dow Chemical Co., The 49
du Pont de Nemours & Co. (Inc.) 71
Duro Metal Products Co. —
Dykem Co., The —
Dynamic Air Engrg., Inc. —

Eaton Mfg. Co. 129
Elastic Stop Nut Corp. of America —
Electric Auto-Lite Co. —
Electric Furnace Co., The 64
Electric Storage Battery Co. —
Electrix Corp. 92
Electro Metallurgical Co. —
Electro Products Laboratories —
Emerman Machinery Corp. 208
Emerson Electric Mfg. Co., The —
Empire Electric Brake Co. —
Ex-Cell-O Corp. —

Fairfield Mfg. Co. —
Federal-Mogul Corp. 134
Federal Press Co., The —
Federal Seal Company 210
Felters Co., The —
Fenn Aircraft Div. —
Firestone Industrial Products Co. 153
Fischer & Porter Co. —
Fisher Furnace Co. 199
Fitchburg Grinding Machine Corp. —
Fitzgerald Mfg. Co., The 204
Flexotube Company —
Foote Bros. Gear & Machine Corp. —
Formica Insulation Co., The 57
Fostoria Industrial Service —
Fuller Mfg. Co. 186
Fulton Sylphon Co., The 89

G & O Mfg. Co. —
Gabriel Company —
Gairing Tool Co., The —
Galland-Henning Mfg. Co. 59
Gear Grinding Machine Co. 163
Gemmer Mfg. Co. 169
General Analine & Film Corp. 171
General Controls 60
General Electric Co. 168
General Machinery Corp. —
Gibson Company, Wm. D. —

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

Gisholt Machine Co. 12
Gits Bros. Mfg. Co. —
Globe Steel Tubes Co. —
Govro-Nelson Co., The 208
Grammes & Son, Inc., L. F. 197
Grand Specialties Co. 207
Great Lakes Steel Corp. 133
Greenlee Bros. & Co. —
Grizzly Mfg. Co. 105
Guiberson Diesel Engine Co. —

Hall Mfg. Co. 165
Hansen Mfg. Co., The 155
Harper Co., The H. M. —
Harrisburg Steel Corp. —
Hayes Industries, Inc. 65
Heald Machine Co., The 2nd Cover
Herbrand Corporation, The 94
Hercules Powder Co., Inc. 79
Hills-McCanna Co. 190
Hollingshead Corp., R. M. 191
Holliston Mills, Inc., The —
Hooven, Owens, Rentschler Co. —
Hoover Ball & Bearing Co. —
Hotel Pittsburgher 208
Houdaille-Hershey Corporation —
Houghton & Co., E. F. —
Howell Electric Motors Co. —
Hyatt Bearings Div. G. M. Corp. 85
Hycar Chemical Co. 122
Hydraulic Machinery, Inc. —
Hydraulic Press Mfg. Co., The 66-67
Hydropress, Inc. 61

Imperial Brass Mfg. Co., The —
Independent Engineering Co. 172
Indium Corp. of America —
Industrial Gear Mfg. Co. —
Inland Mfg. Div. G. M. Corp. —
Inland Steel Co. 41
International Nickel Co., Inc., The —
International Screw Co. —

Jenkins Bros. —
Jessop Steel Co. 138

Johnson Bronze Co. 87
Jones & Lamson Machine Co. ..... —

Kay Products Company ..... —
Kearney & Trecker Corp. ..... —
Kempsmith Machine Co. ..... —
Kester Solder Co. ..... —
King-Seeley Corp. ..... —
Kling Bros. Engrg. Wks. ..... —
Kold-Hold ..... —
Koppers Co. 55
Kropp Forge Aviation Co. ..... —

Ladish Drop Forge Co. ..... —
Lamson & Sessions Co. ..... —
Lapointe Machine Tool Co. ..... —
Lawson Machine and Tool Co. 201
Layne & Bowler, Inc. ..... —
Lear Avia, Inc. 145
LeBlond Machine Tool Co., R. K. —
Leeds & Northrup Co. 189
Libbey-Owens-Ford Glass Co. ..... —
Lift Trucks, Inc. 199
Lincoln Electric Co., The ..... —
Lincoln Engineering Co. 174
Lincoln Park Industries, Inc. 177
Lindberg Engineering Co. ..... —
Lister-Blackstone, Inc. 54
Littelfuse, Inc. 210

North American Electric Lamp Co. 211
Northern Indiana Brass Co. ..... —
Norton Company ..... —
Nox-Rust Corporation 4

Ohio Rubber Co., The 178
O'Neil-Irwin Mfg. Co. ..... —
Onsrud Machine Wks., Inc. 2
Ozalid Products Div. 171

Paasche Airbrush Co. 52
Page Steel & Wire Div. American Chain & Cable Co., Inc. ..... —
Palnut Co., The 96
Panelyte Div., St. Regis Paper Co. 187
Parker Co., The Charles ..... —
Parker-Kalon Corp. ..... —
Pawtucket Screw Co. ..... —
Pease Co., The C. F. ..... —
Pedrick Piston Rings ..... —
Peerless Machine Co. .....
Pennsylvania Salt Mfg. Co. 95
Perfex Gage & Tool Co. 69
Permatex Co., Inc. 45
Pesco Products Co. ..... —
Pheoll Mfg. Co. ..... —
Philadelphia Rust Proof Co. 206
Phillips Screw Mfrs. ..... —
Physicists Research Co. ..... —
Pierce Governor Co., Inc., The 120
Pioneer Rubber Co. ..... —
Pittsburgh Lectromelt Furnace Corp. ..... —
Pittsburgh Plate Glass Co. ..... —
Pittsburgh Steel Co. ..... —
Porter-Cable Machine Co. ..... —
Potter & Johnson Machine Co. 211
Poulsen & Nardon, Inc. 146
Powder Metallurgy Corp. ..... —
Pratt & Whitney (Division Niles-Bement-Pond Co.) 123
Preis Engraving Mach. Co., H. P. —
Progressive Mfg. Co., The 205
Purolator Products, Inc. ..... —

Racine Tool & Machine Co. ..... —
Radiator Shutter 204
Ramsey Access. Mfg. Corp. ..... —
Reading Screw Co. ..... —
Reeves Brothers, Inc. 179
Republic Steel Corp. 152
Resistoflex Corporation ..... —
Reynolds Metals Co. 116
Rhode Island Tool Co. 203
Rhodes & Co., Jas. H. 206
Riehle Testing Machine Div. of American Machine & Metals, Inc. —
Rockford Die & Tool Works, Inc. —
Rockford Drilling Machine Div. 206
Rodic Rubber Corp. ..... —
Rohm & Haas Co. 131
Russell, Burdsall & Ward Bolt & Nut Co. ..... —
Ryerson & Son, Inc., Joseph T. 185

SKF Industries, Inc. ..... —
Saginaw Malleable Iron Div. G. M. —
Sav-Way Industries 136
Scandia Mfg. Co. ..... —
Schrader's Son, A. 91
Sciaky Bros. 210
Scovill Mfg. Co. 91
Scully-Jones & Co. ..... —
Sealed Power Corp. 51
Seneca Falls Machine Co. ..... —
Service Caster & Truck Div. Domestic Industries, Inc. 201
Shakeproof, Inc. 73
Sheffield Corp., The 99
Sheldon Machine Co. ..... —
Shore Instrument & Mfg. Co., The —
Shuler Axle Co., Inc. ..... —
Siewek Engineering Div. of Domestic Industries, Inc. ..... —
Silent Hoist Winch & Crane Co. ... —
Simmonds Aerocessories, Inc. 211
Simplex Products Corp. 206
Snap-on Tools Corp. ..... —
Snyder Tool & Engrg. Co. 180
South Bend Lathe Works ..... —
Southington Hardware Mfg. Co. ... —
Speedway Mfg. Co. ..... —

Spencer Turbine Co., The ..... —
Sperry Products, Inc. ..... —
Spicer Mfg. Co. ..... —
Spun Steel Corporation 158
Square D Company ..... —
Standard Molding Corp. 198
Standard Oil Co. (Ind.) ..... —
Sterling Aluminum Products, Inc. .. —
Sterling Tool Products Co. ..... —
Stow Manufacturing Co. ..... —
Strom Steel Ball Co. ..... —
Stromberg-Carlson Co. ..... —
Stuart Oil Co., Ltd., D. A. 209
Sturdimatic Tool Co. ..... —
Sturtevant Co., P. A. 108
Superior Coach Corp. 205

Taylor Fibre Company 196
Terry Co., Geo. A. ..... —
Texas Co., The ..... —
Thompson-Bremer & Co. ....3rd Cover
Thompson Mfg. Co., Earl A. ..... —
Timken Roller Bearing Co., The Front Cover
Tinnerman Products, Inc. 58
Titeflex, Inc. ..... —
Tobe Deutschmann Corp. 13
Tomkins-Johnson Co. ..... —
Torrington Co., The ..... —
Tourek Mfg. Co., J. J. 159
Transue & Williams Steel Forging Corp. ..... —
Treasury Dept. 192
Tube-Turns, Inc. ..... —
Tung-Sol Lamp Works, Inc. ..... —
Turco Products, Inc. ..... —
Turner Gauge Grinding Co. ..... —
Tuthill Pump Company 204
Twin Disc Clutch Co. 14

U. S. Automatic Corp. 202
Udylite Corp., The ..... —
Union Carbide & Carbon Corp. .... —
United Screw & Bolt Corp. ..... —
United Specialties Co. 210
United States Rubber Co. ..... —
United States Steel Corp. ..118-119-166
United States Tool & Mfg. Co. ..... —

Van der Horst Corp. of Amer. 127
Vard, Inc. 161
Vascoloy-Ramet Corp. 210
Vickers, Inc. ..... —
Victor Mfg. & Gasket Co. 6
Vinco Corporation 182
Visco-Meter Corp. 98
Vulcan Corp. ..... —

Waldes-Koh-I-Noor, Inc. 125
Walker-Turner Co., Inc. 197
Ward Products Corporation, The .. —
Warner Electric Brake Mfg. Co. ... 135
Watson-Stillman Co., The ..... —
Waukesha Motor Co. 1
Weatherhead Co., The 141
Wells Mfg. Corp. 157
Western Auto. Mach. Screw Co. ... —
Western Felt Works 126
Westinghouse Elec. & Mfg. Co. Back Cover, 76-77-117
Wetmore Reamer Co. 143
Whitaker Cable Corporation 151
White Dental Mfg. Co., The S. S. ...
Whitney Metal Tool Co. 204
Whitney Screw Corp. ..... —
Wilcox Rich Div. ..... —
Wilkening Mfg. Co. 10
Wilson Welder & Metals Co., Inc. . 53
Wittek Mfg. Co. 209
Wolverine Tube Div. ..... —
Wobdworth Co., N. A. ..... —
Worcester Stamped Metal Co. 210
Wrigley, Jr., Co., Wm. ..... —
Wright Mfg. Div. American Chain & Cable Co., Inc. ..... —
Wyman-Gordon 83

Yoder Co., The ..... —
Young Radiator Co. ..... —
Young Spring & Wire Corp., L. A. —

Zollner Machine Works ..... —

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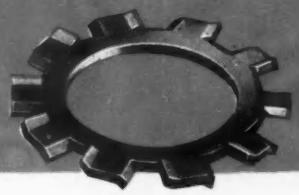

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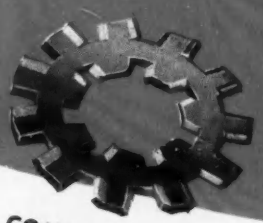

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